

EXHIBIT 1

What is CTE?

STAGE I	STAGE II	STAGE III	STAGE IV
Short-term memory difficulties	Short-term memory loss	Memory loss with mild dementia	Severe memory loss with dementia
Executive dysfunction	Executive dysfunction	Executive dysfunction	Executive dysfunction
Loss of attention and concentration	Loss of attention and concentration	Loss of attention and concentration	Profound loss of attention and concentration
Explosivity / aggression	Explosivity / aggression	Explosivity / aggression	Explosivity / aggression
Suicidality	Suicidality	Suicidality	Suicidality
Headaches	Headaches	Headaches	Depression
	Mood swings or depression	Mood swings or depression	Impulsivity
	Impulsivity	Impulsivity	Language difficulties
	Language difficulties	Language difficulties	Visuospatial difficulties
		Visuospatial difficulties	Apathy
		Apathy	Paranoia

Source: McKee et al. 2013 (Nitz Decl. Ex. 5)

EXHIBIT 2

GRANTLAND

The Woman Who Would Save Football

Dr. Ann McKee has been accused of trying to kill the sport she loves, but she may be its only hope.

BY JANE LEAVY ON AUGUST 17, 2012



The door to Ann McKee's office is a shrine to the human brain: artistic, scientific, and comic. An iridescent Andy Warhol carrying a Campbell's Soup can keeps company with a newspaper photograph of the anatomist and neurologist who created the Wilder Brain Collection at Cornell University. A teenage boy slouches across a 2006 cover of *The New Yorker*, the lobes of his not-yet-adult brain depicted under a baseball cap. "MySpace" dominates his prefrontal cortex, an illustration of just how much has changed in social media, sports, and brain science. A bumper sticker asks, "Got brains?"

Brains she's got. Brains in glass jars in the storage room across the hall from her office. Brains blown up in digital images taken from autopsies she has done on some of America's most famously deceased athletes. Brains stored in a deli case in white plastic tubs that might otherwise accommodate 10 pounds of potato salad. Brains in baggies, slices of tissue that, she says, remind some people of the pickled ginger served with sushi.

This is the Brain Bank at the Bedford Veterans Administration Medical Center in Bedford, Massachusetts. Here, in a small room dominated by stainless steel, McKee performs autopsies. She examines the brains of athletes — men and women — who, without really knowing it, put themselves in harm's way. She sees the brains of soldiers who knew the risk. In all of them, she sees what happens

when the brain is assaulted.

Among other things, Ann McKee is chief neuropathologist for the VA, Boston University's Alzheimer's Disease Center, the Framingham Heart Study, the New England Centenarian Study, and the Center for the Study of Traumatic Encephalopathy, which was created in 2008 to examine the impact of collisions between oversize human beings in pursuit of balls, yards, pucks, wins.

She is a mother, a painter, and a frustrated jock who says she can't keep up with her family. She is exhausted and inexhaustible. "I think it shows, but I can't stop."

Only she thinks she looks her age — 59. "Most neuropathologists look and sound like they've spent time in formaldehyde," says David Hovda, director of the UCLA Brain Injury Research Center. "Ann, well ... "

"She's a brilliant scientist who happens to be a little blonde bombshell," says Eleanor Perfetto, widow of former offensive lineman Ralph Wenzel, whose brain tissue is currently being studied in McKee's lab. Like McKee, Perfetto, a pharmacist who has a Ph.D. in public health and a senior position at Pfizer, knows the challenges of being a woman in a male-dominated world. "That's why people look at her and think, This is a woman who cuts up brains? There's such a dichotomy. Her work is something a lot of people would not want to do, and certainly not a lot of women. She's so unexpected."

"I'm a Cheesehead," McKee says.

This explains the framed 1968 Green Bay Packers yearbook and the January 22, 1969, cover of Sports Illustrated with Jerry Kramer cradling Vince Lombardi in his arms. Her pooches at home wear Green Bay Packers dog tags. Within reach of her desk, she has a roster of empty-headed bobbleheads — Brett Favre in green-and-gold, in white-and-green, in purple-and-white; and Aaron Rodgers, Favre's estimable successor in the huddle and in her affections. And a hero of another kind of artistry — a ringer in street clothes named Vincent van Gogh.

Every football Sunday, she parks herself in front of the TV in her authentic Packers foam Cheesehead (\$17.95 at packersproshop.com) and Rodgers's no. 12 jersey and prays that none of the men on the field end up on a dissection table. To date, she has found ravages of CTE, the neurodegenerative brain disease that has become her life's work, in over 70 athletes, nearly 80 percent of those she has examined. Among them: 18 of the 19 NFL players she has autopsied; three NHL enforcers; and a boy just 17 years old. McKee, who received \$1 million in funding from the VA as well as a home for her lab, has also documented evidence of CTE in combat veterans exposed to roadside bombs.¹

¹. "I have absolutely zero concern that it is influencing her research," says Dr. Ramon Diaz-Arrastia, director of clinical research at the Center for Neuroscience and Regenerative Medicine at the Uniformed Services University of the Health Sciences, who knows how hard it is to get scientific funding as well as McKee's scrupulous reputation.

"The coolest thing about Ann is she spends all day doing autopsies on NFL players and can't wait for the weekend to put on her Packer sweatshirt and climb into bed with a big bag of popcorn and a beer," says Gay Culverhouse, former president of the Tampa Bay Buccaneers, who now advocates on behalf of former players.

"Well, I don't usually do it in my bed," McKee says.

The Packers' loss to the Giants in the playoffs was a blow, but also an opportunity to work. By Super Bowl Sunday, she had recovered sufficient equilibrium to host a family party. She wore her Cheesehead — and even volunteered to send me a photograph. “I love it — I love football,” she says, her face falling like the pocket collapsing around her favorite quarterback. “I’d like to put everything I know about it in another room when I’m watching it. But it’s hard to do it through the whole game. I have enormous admiration for the physical athleticism and ability. It’s strategic but requires skill that most people don’t have. I get extremely caught up in it. At the end of the game I think, How could I watch this?”

The day America gave itself to Super Bowl XLVI feels as long ago as the Roman Empire. Since then?

- March 2: NFL commissioner Roger Goodell announces the findings of an investigation into bounty hunting by the New Orleans Saints, a system — football’s favorite word — organized by defensive coordinator Gregg Williams.
- March 21: Goodell suspends Williams as well as Saints general manager Mickey Loomis and head coach Sean Payton.
- April 4: A tape recording of Williams’s pregame exhortation is released: “Kill the head, the body will die.” (Those pregame, pep talk fighting words sicken Perfetto. “I’ve seen what happens when the brain is killed,” she told me a month before her husband’s death. “It is a long, agonizing journey for that body to die.”)
- April 19: Ray Easterling, former Falcons safety, commits suicide. He and his wife were lead plaintiffs in the first class action suit filed against the NFL, in August 2011, seeking damages for seven former players. A year later, there are approximately 113 suits pending, involving more than 3,000 players, which have been consolidated into a master complaint in federal district court in Philadelphia. This class action suit charges the NFL and official helmet maker Riddell with negligence and hiding information linking football-related head trauma to permanent brain injuries.²
- April 30: Headstrong, an Off-Broadway play about a former NFL player living with post-concussion syndrome, premieres.
- May 2: Goodell suspends four Saints players, including Jonathan Vilma and Scott Fujita, a member of the NFL Players Association executive committee who has advocated for independent neurologists to be on the sidelines. That same day, Junior Seau, a future Hall of Famer who did not have a diagnosed history of concussions, was found dead with a self-inflicted gunshot wound to the chest — the same awful methodology Dave Duerson chose when he killed himself, leaving a suicide note asking that his brain be left in care of Ann McKee and her team. The findings of CTE in Duerson’s brain were released on May 2, 2011.
- June 13: Pop Warner football, which registered more than 285,000 children ages 5-15 to play in 2011, bans head-to-head hits and limits contact in practice to 40 minutes a day. That night, Terry Bradshaw, the former Steelers quarterback who now receives treatment for short-term memory loss at the Amen Clinic in Newport Beach, California, told Jay Leno: “In the next decade, we will not see football as it is.”

² Grade 4, a more florid form of Grade 3, is generally only seen in those who live with the disease longer. “Mostly people who have lived into their 60s or 70s or who had prolonged, extensive exposure, a long career, or both,” says Cantu, chief of neurosurgery and director of sports medicine at Emerson Hospital in Concord, Massachusetts.

It is a measure of the sea change in public perception that Junior Seau was immediately popularly diagnosed with CTE, despite the existence of personal problems that might have played a role in the suicide. On July 12, his family announced that part of his brain tissue had been donated to the National Institutes of Health’s National Institute of Neurological Disorders and Stroke for study. Two weeks later, Goodell announced the creation of NFL Total Wellness, a new program of mental health benefits, including Life Line, a free telephone service staffed by mental health professionals and suicide prevention experts. The next day the medical examiner in Richmond, Virginia, confirmed a diagnosis of CTE in Easterling’s brain.

The potential cost of employment in McKee’s favorite sport is never far from her mind. She reaches for Green Bay Brett and flicks his molded-plastic noggin with her finger. The oversize head bobbles and wags, lurching back and forth on its spring like a kid trying out a pogo stick. Only the smirk on his prefab mug remains fixed.

“Get the irony?” she says.

Over the last four years, McKee has become the most visible member of a cohort of research scientists and family members — wives, mothers, daughters, and sisters of the dead, dying, and demented — who have forced the issue of chronic brain trauma into the forefront of American consciousness. The process has engendered enormous publicity as well as criticism and jealousy in the scientific community, which is every bit as competitive as the NFL. Her work has brought “a great deal of acclaim, exposure, and recognition,” says neurosurgeon Robert Cantu, clinical professor of neurosurgery at Boston University and co-director of CSTE. “But at the same time it’s brought a great deal of pressure. Not everybody greets her findings with the same degree of enthusiasm.”

War-painted denizens of the upper deck may view her as The Woman Trying To Destroy Football. In fact, she is The Woman Trying To Save Football From Itself. The process has engendered a particular intimacy with those who entrust their loved ones to her posthumous care. Virginia Grimsley, whose husband, John, was the first NFL player diagnosed by McKee, says, “He’s in good hands with her. They’re all in good hands with her.

“If Joe Six-Pack was as educated as the wives that have gone through this and as Dr. McKee, Joe Six-Pack would sit down, shut up, and continue to drink his six-pack,” Grimsley says. “She’s not trying to destroy football.”

McKee says: “I’m just trying to tell football what I see.”

What she sees through her microscope is mediated by a painterly sensibility that suffuses how she talks about her work, how she approaches it, and how she presents it. She was an art major freshman year at the University of Wisconsin. She gave it up in favor of making a living, but she never quit making art. “I think you have to be creative to make a difference in science,” she says. “So being artistic, it’s not always going with what is accepted. I’m not your run-of-the-mill scientist.”

It took an artist to see beyond Joe Theismann's splintered tibia, Johnny U's gnarled fingers, and Bo Jackson's necrotic hip to the head-banging obvious and to grasp the importance of aesthetics in changing public opinion. "Actually, I do think that makes a big difference," she says. "I think that laying out something in a visually pleasing way is very important. I look at *Mad Men* and how you advertise to get your point across. In order to swing public perception and gain acceptance for your work, you have to be your own advertising firm."

She photographs every brain before autopsy and memorializes slivers of tissue in irrefutable portraits of disease that line the hallways of her lab. Exhibit A: a montage she created from sections of 27 damaged brains, white matter arranged like so many Marilyn Monroes by Andy Warhol. "This is Eric Scoggins," she says. "This is Wally Hilgenberg. This is Mike Borich, a college player. We got it from the coroner, so it's not a complete section. This is John Grimsley. This is Dave Duerson. Up here we have Derek Boogaard, the hockey player."

Some painters revisit a single image again and again — a billowing sail or perhaps a lily pond — finding the particular in the generic. Tau, a protein in brain cells that turns rogue with repeated trauma, is McKee's subject; the brain is her canvas. "If you look at the paintings of Van Gogh, he saw things other people didn't see," Hovda says. "Good neuropathologists see things through a microscope that you and I don't see clearly, and I have spent a lot of time looking through a microscope. It's because they have an artistic appreciation for what they are seeing and the ability to recognize it as pathology. She has demonstrated pathology in a way that is beautiful and irrefutable."

To gaze upon McKee's montage is to see the unseen. Daniel Perl, professor of pathology/neuropathology at the Uniformed Services University in Bethesda, Maryland, who has known and worked with McKee for two decades, says: "I think she has completely changed the way we see the experience of playing football."

Can I see a brain?" I ask.

"Sure, we can go to the morgue," she says.

She leads the way down the hall to an unprepossessing room in an unprepossessing brick building on the campus of the Edith Nourse Rogers Memorial Veterans Hospital. Currently, there are 125 brains registered to the Brain Bank, among them 21 veterans who experienced mild traumatic brain injury. Chris Nowinski, co-director of CSTE and founder of the Sports Legacy Institute, a nonprofit organization dedicated to concussion awareness, secures the donations. Five hundred athletes — including him — have promised their brains to McKee.

They arrive in buckets packed in Styrofoam boxes, inside plastic bags on wet ice. Sometimes, after hours, deliveries are made to her home. Once, inadvertently, a box was left with a neighbor. "I can only imagine what they were thinking," she told Mark Kram of the *Philadelphia Daily News* in 2009. It hasn't happened since.

The contents are precious, so on-time deliveries are essential. "Our greatest fear is that something will get lost," she says. "We have to go from hand-to-hand-to-hand."

At the lab, the brain is weighed, photographed, and preserved in fixative, a Formalin derivative that firms

the tissue and makes it easier to cut. Half will be frozen at 80 degrees below zero Celsius for future investigators; the other half becomes McKee's raw material.

McKee regards each as a charge, a challenge, a privilege, a person. "It's actually the person of the body," she says. "If you don't have a brain, you have no identity."

She sees beauty in the infinite handiwork of the human brain and the complexity of its structure. "I do love the way the brain looks. I love the way it's shaped. When I see a brain that's been damaged, it hits you like — "

She stops.

"You see tearing of certain structures. You see holes where they shouldn't be. You see shrinkage."

She has seen brains that have defied aging and those that have aged prematurely; brains that have sustained damage from a concussive rocket blast 150 feet away and brains damaged from one too many head butts at the line of scrimmage. She has seen so many brains she has lost count. "Somewhere in the thousands," she says. "One hundred and fifty a year for 25 years — what's that?"

In the morgue there is a single autopsy table, and a drawer labeled FEET FIRST, HEAD BY DOOR. Her colleague Dr. Victor Alvarez opens the drawer, revealing the remains of an unidentified donor swaddled in a crisp white hospital sheet, a bundle as small as an Egyptian mummy. "Just like on TV," he says.

At McKee's behest, Alvarez retrieves the atrophied brain of an elderly veteran from a white bucket. Fixative had rendered it the color of a peeled potato too long exposed to the air. The weight was scribbled in Magic Marker — 1,017 grams.

"Should be 1,400," McKee says — the size of a small chicken. "The NFL guys should be 1,600. Some of them weigh half that much."

Alvarez placed the brain on a black cutting board atop the stainless steel table and took up his scalpel. He paused, almost imperceptibly, before making the practiced and decisive cut.

It felt like a sacred pause.

"That moment of awe lasts a long time, because you not only open the box but then you investigate, take photographs," McKee says. "There's a somberness that sometimes comes over the room because you're now starting to become involved."

There is excitement too. She doesn't want anyone to get the wrong idea of what she means by this. It is the exhilaration bred from intellectual rigor, the thrill of scientific discovery and the tantalizing prospect of finding a way to diagnose the disease in the living and intervene in the degenerative process before too much damage is done. The work is compelling and consuming. One morning, two new donations were delivered to the lab at the same hour a widow arrived to see where her husband had been diagnosed. McKee asked: "Do you mind if I just ... ?" The visitor understood: She just couldn't wait to take a look.

By definition, pathology begins with the denouement. "Now you're at the end, and then you're going to slowly unravel the mystery, the puzzle," McKee says. "You start with what the brain looked like at death,

get an idea of how impaired it was, and then over the next few months you're going to unravel the rest of the story."

She may know if the donor on her table played football or hockey or launched one too many headers on goal. Scientific bias precludes any further familiarity. Googling will have to come later. "I have to know the name," she says. "A number of times it's come up they want me to just use numbers, and I can't do that. It's got to have a name because it is a person, a life."

She was born into a football family in a football town some 30 miles from Lambeau Field. As a young girl she was known as AC — as in the spark plug — because she was the fastest kid in school.

Growing up she loved Barbie as much as she did Bart Starr. Of course. "She got Ken and all those wigs," McKee says.

She was a cheerleader in high school — "The only sport they allowed me to do." Her brothers played college football — as did her father, whose 1930s team picture from Grinnell College hangs in the conference room where we met. "We would spend nearly the whole summer at Post Lake," she says. "Our best friend was the high school coach, and so Mr. Dillon would have us run the tires every morning and we did football practice. That is what we'd do all summer. My brothers would let me play."

McKee on McKee: "I had promise."

She was the youngest of five children, seven years younger than the next-oldest sibling, Chuck, a star high school and college quarterback. "I just admired him like crazy," she says. "I went to every game of his. One time when I was 8 I put a sign in the yard because people would go past our house to get to the stadium: 'Chuck McKee lives here.'"

The NFL was interested, but he wasn't. "He didn't think it was so good for him, actually," she says. "He didn't say it was about his brain, but I think he was looking at his longevity. He went to medical school instead. He's a huge reason why I'm in this business."

Last on the familial depth chart — "shorter, slower, dumber — last to the table, the last in everything," she learned to "fight and scratch for position." Good training for future tussles with the NFL. A twice-divorced mother of three, she presides over an almost empty nest — her 26-year-old daughter is a med student and a newlywed; her 22-year-old son played soccer, not football. He was a great goalie, his mom says, and would have been a great wide receiver. "I would have loved him to play, because it's what you do in my family. His dad didn't want him to play. And I thought my husband was the biggest wimp because of that. Turns out now it might have helped him."

Her 16-year-old daughter lives at home in Massachusetts. "I'm still dealing with driving carpool," McKee says, rolling her eyes. "I've been a mother for a l-o-o-o-n-g time."

The no-nonsense pantsuits and plain button-down shirts she favors in public appearances may be appropriate to her very particular workplace, but do not succeed in lowering her profile. Hip red reading glasses that magnify piercing blue eyes are accompanied by an unexpectedly girlish giggle and a mordant sense of humor. She has stared down congressmen and NFL officials with those baby blues. ("She's not exactly Jack Klugman," says Robert Stern, a co-director of CSTE.)

Initially McKee was greeted by the league as enthusiastically as Vikings fans at Lambeau Field. She first met with what was then called the “Mild Traumatic Brain Injury Committee” at NFL headquarters in New York on May 19, 2009. She remembers sitting at an “enormous boardroom table with a bunch of non-smiling men in suits. The atmosphere was cool and noticeably testosterone-filled,” she says. “There were a total of two females in the room.

“The reception was one of complete dismissal. The men representing the NFL had made up their minds that anything I had to say was not accurate or not applicable. After I spoke, there was continued denial that the findings had any merit, and they proceeded to let me know that.”

“If she sat in the corner and I showed the pictures, the response would have been the same,” says Dan Perl, who also addressed the meeting. But over the years, McKee’s heightened profile and accumulated results have engendered some not-so-subtle sexism. “Being marginalized by the NFL and a lot of our colleagues — that has a lot to do with being a woman,” says Perl.

The October 28, 2009, hearings before the House Judiciary Committee represented another Rubicon. Before swearing an oath, she had to decide, “How much did I believe it?” The demented condition of a childhood hero — the Packers’ splendid safety Willie Wood — was deeply affecting, as was her testimony and that of Culverhouse, and Perfetto, all of which left Congressman Lamar Smith fuming and Congressman Ted Poe grumping about “the end of football as we know it.” Why, if Congress gets involved, Poe grouched, “we would all be playing touch football out there.”

“I love the scowl she gave the congressmen,” Virginia Grimsley says. “I’d like to give them a scowl myself.”

Within a month the NFL had accepted the resignations of the co-chairmen of its discredited brain injury committee and configured a new one: the Head, Neck and Spine Committee. Cantu serves as a senior adviser, as well as medical director of the National Center for Catastrophic Sport Injury Research. In April 2010 CSTE received \$1 million in unrestricted funds from the NFL, part of which has funded McKee’s research whether it’s something the NFL agrees with or not.³

³: A study published in May in the journal Science Translational Medicine linked CTE in athletes to military veterans exposed to concussive battlefield blasts. The study, authored by McKee and Lee Goldstein of the Boston University School of Medicine, comparing autopsies of four athletes and four veterans, suggested that roadside bombs injure the brain in ways strikingly similar to tackles and punches. They also demonstrated evidence of the disease in laboratory animals two weeks after being exposed to a single blast.

But giving voice to the dead on 60 Minutes, in the pages of the New York Times, and before Congress (four of 25 pages on her CV are devoted to media appearances) has also made her a target. Richard Ellenbogen, co-chairman of the NFL’s Head, Neck and Spine Committee and chairman of the Department of Neurological Surgery at the University of Washington School of Medicine, says she needs to publish more in peer-reviewed journals and conduct studies with controls comparing incidence in collision sports with other athletes, such as rowers and female basketball players. He also says she has crossed the divide from hard science into advocacy. “She’s possessed,” says Ellenbogen. “She is no longer impartial.”

This is a charge Cantu adamantly rejects: “She is a scientist first, not an activist first.”

McKee sighs. “You get enemies in this business.” She must tread a not-so-fine line between SLI’s advocacy mission and the publishing protocols of medical research. “This was discussed from the day we started working together,” Nowinski says. “She recognized she would be criticized in academic circles for talking about [some of] the work before academic publication. A lot of the blame — pushing for some of the information to get out comes from me.”

Hovda, whose research into the neurobiology of concussions demonstrated the vulnerability of the brain to second insults, says McKee’s science is rigorous, significant, and does not overinterpret the available data, which is inherently limited by the facts of neuropathology — you only get to diagnose people who are already dead.

The bull’s-eye on her back is likely to remain there as long as postmortem exam remains the only way to diagnose CTE. Progress toward identifying the disease in the living has been rapid — compared to the agonizingly slow pace of Alzheimer’s disease research. Blood tests for tau, diffusion tensor imaging, functional MRI, and biomarkers that will allow doctors to image the disease are all in development. Already, Hovda says, researchers at UCLA can image tau and beta-amyloid deposits in laboratory animals, and may be able to do so in humans within the year. “I’d love to put her out of this business,” he says. “And I bet Ann would love me to put her out of business.”

McKee says: “I’ll keep this up as long as it takes.”

Longevity runs in her family.

She never expected to get inside the head of the NFL. She thought she would become an internist and turned to neurology and neuropathology not to get away from people but to get closer to what makes them uniquely themselves. “They entrust me with their privacy, really,” she says. “What a person’s tissues look like, what struggles they were going through during life, and then what disease they have at death is a very private matter. That’s as naked as you could possibly be. It’s revealing yourself and revealing your internal structure.”

For 25 years she studied tau in perfect anonymity, trying to understand its pivotal role in aging and Alzheimer’s disease.

“Why tau?” I asked.

“Because it’s pretty,” was the artist/pathologist’s reply.

The tau protein, named for the 19th letter of the Greek alphabet, is a naturally occurring substance in brain cells. Its job is to hold together microtubules, which are rigid, hollow rods like beach reeds that serve as conduits between brain cells. Tau provides “the scaffolding to support its shape and also to help transport molecules, nutrients, back and forth,” McKee says. “Without tau the cell would collapse and the transport functions would be critically impaired.”

With repeated head trauma tau turns insurgent, a guerrilla force occupying and killing more and more of the brain. “It falls off the microtubules, and so they fall apart too,” McKee says.

Each concussive blow to the head — a right cross, a body check into the boards, a helmet-to-helmet collision in the open field, a header inside the goalie's circle — becomes a potential IED, a bomb hidden on a neural pathway. Think of it this way, she says: "This transport function of the cell is just like a road. And the road just fell apart."

Dementia pugilistica — punch drunkenness — first appeared in the medical literature in 1928. In 2002, Bennet Omalu, then a neuropathologist at the University of Pittsburgh, diagnosed the first known case of CTE in former Pittsburgh Steeler Mike Webster. He joined forces with Chris Nowinski, who procured three more donations, including former Eagle Andre Waters. All showed evidence of CTE.

In 2003, McKee performed an autopsy on a 72-year-old veteran who had been diagnosed with Alzheimer's disease 15 years earlier. She found toxic tangles of tau common to Alzheimer's and CTE, but they appeared in a totally unfamiliar pattern. And there was no evidence of the beta-amyloid plaques also present in Alzheimer's patients.

After the autopsy, she learned he had been a world-champion boxer. "That was the aha moment," she says. "I kept asking my colleagues if they had another boxing brain. I couldn't get it out of my mind."

McKee's laboratory does the neuropathology work for the Framingham Heart Study, the landmark multi-generational investigation into causes of heart disease. "I went back and stained all the Framingham heart disease cases we had, looking for a pattern of change that looked anything like this. I have drawers and drawers and drawers of these slides, and nothing looked like it.

"Then [in 2005] we got another through the Alzheimer's Center. There wasn't any history of head trauma. I went through all the medical records and nothing, so I got the name of the family. And I called the daughter, and she said, 'Well, he did box professionally in his 20s.' So, that was like, 'Okaaaay.'"

In 2008 Nowinski came calling. He had parted ways with Omalu. He was also suffering the consequences of his WWE career, when he was known as Chris Harvard. Four wrestling concussions and two others on the gridiron had left him with severe headaches and impaired short-term memory — although he hasn't forgotten the taste of blood in the back of his throat that accompanied hits he took as a defensive tackle for the Crimson. (Thanks to a recent pickup basketball game, the count is now seven.)

He consulted Cantu about his symptoms. The doctor-patient relationship evolved into a professional alliance. They created SLI and later partnered with Robert Stern, director of Boston University's Alzheimer's Disease Clinical & Research Program, to create the Center for the Study of Traumatic Encephalopathy with the goal of acquiring and examining brains of deceased athletes exhibiting symptoms of premature dementia. All they needed was someone to do the autopsies. "Have I got the neuropathologist for you!" said Stern.

McKee sounds a lot like a football coach when she talks about her team at the Brain Bank, except, she says, her people give 400 percent. Over the course of three or four painstaking months, McKee's staff will cut half the brain into slices the thickness of white bread. They will use a high-tech deli slicer called a Microtome to shave 50-micron slivers of tissue — 0.001968 inches — which will shrink to less than half that size and be stained, fixed to slides, and magnified, perhaps 100 times, under the microscope.

"Handwork," she calls it.

Unstained, tau is unidentifiable. Staining makes the texture and the damage palpable. Some pathologists use a blood-red color to dramatize areas of disease. McKee favors brown, the color of dried blood.

On the day I visited, she spoke about the woman who prepared her slides for the last decade and whose devotion to her craft, despite failing health, was that of a mother hoping to find a way to protect her son. “An artisan,” McKee calls her. “Like a person who makes a mosaic out of a million little pieces. It can take three or four hours just to lay the tissue out on the slide” — not including cutting and staining — “because you get it when it’s wet and you have to manually smooth down every single teeny-tiny wrinkle.”

John Grimsley, a linebacker who suffered three concussions in college and eight in the NFL, was the first NFL player whose tissue they examined. What McKee saw was so unprecedented in her experience that she twice asked Dan Perl to come look at the slides. It was a case of: Do you see what I see? He did. “When you look at the tangles, you say, ‘Wow,’” Perl says.

While McKee and her staff dissect and preserve tissue, Stern, who oversees the CSTE registry, interviews family members to develop a case history: number of years and position played and in what decade, number of concussions suffered and symptoms noted. The most frightening finding is that “the biggest problem isn’t the concussions, actually,” McKee says. “It’s the sub-concussive hits that mount up every single time these guys line up.”

It’s been estimated that there are 1,000 to 1,500 of those kinds of hits per season per person in the NFL. “A big job liability,” she says.

In November, Stern received a \$1.5 million grant from the National Institutes of Health to study 100 former players between ages 40 and 69 with symptoms consistent with CTE who played positions at the greatest exposure for getting hit in the head — defensive linemen, linebackers, offensive linemen, and defensive backs. The goal is to establish risk factors for the disease and genetic predisposition. “If we can figure out the genetic risk, we could be much smarter about informing individuals who are considering playing these sports what their relative risks are,” McKee says.

Despite new NFL rules limiting the number of padded practices, and protecting defenseless receivers, the cumulative effect of violent collision remains dire. McKee believes there is “a window of reversibility” of perhaps one year before the disease has had “a chance to gain speed [and] cause the cells to die.”

Stern: “With each brain that comes in, especially the younger ones, and especially the ones without any known significant history of concussions, but a whole lot of sub-concussive blows, that’s where she gets really scared. That’s where we all get really scared.”

Posters hanging in the conference room show the sickening march of the disease — an 18-year-old who looked like he had cigarette holes burned in his brain; Owen Thomas, a junior and co-captain of the University of Pennsylvania football team who never suffered a concussion; Dave Duerson, who played 11 years in the NFL.

McKee has developed a four-tier system for staging the disease that first invades the front cortex — the province of judgment, insight, inhibition, and concentration — and then begins to “work its way inward, penetrating the essence of a person.”

Staging is determined by the amount and distribution of tau. In Grade 1, a few hot spots appear on the surface, clustered around small blood vessels. “You see those holes on the side walls, the holes and tangles in a circle around the hole?” she says, pointing to Owen Thomas’s damaged brain tissue. “That’s a 21-year-old brain!”

The blood vessels vex her and perplex her. “Why the blood vessels?” she says, tracing a painterly splatter on his brain with her forefinger. “What am I missing?”

She was talking to the disease, not to me.

In Grade 2, the spots multiply but most brain tissue is undisturbed. Thomas had Grade 2 of the disease when he committed suicide; the 18-year-old had Grade 1.

In Grade 3, the neurofibrillary tangles she likens to skeins of unraveling yarn invade multiple lobes of the brain. Besieged, the medial temporal lobe atrophies. The hippocampus, essential for learning and memory, is attacked. The amygdala, which governs aggressiveness and rage, is assaulted. Symptoms multiply and intensify: headaches, depression, insomnia, anxiety; loss of impulse control, executive function, and emotional regulation; tremors, vertigo, slurred speech and a staggered gait; and finally dementia.

A slide of Dave Duerson’s tissue demonstrates the awfulness of Grade 3 CTE. Under the microscope his brain tissue looks like the bark of a tree. “You see all those little spots of damage?” McKee says. “And he doesn’t even have the worst case of this. This is really substantial disease, especially since he’s only 50.”⁴

⁴ There is also litigation pending against individual franchises. Eleanor Perfetto filed the first workman’s compensation claim, against the San Diego Chargers, on her husband’s behalf in April 2010. Her attorney expects the first of the 50 such suits he is handling to go to trial in January.

Women lose lovers, friends, husbands, partners. Men lose their way, their memories, their lives. Ministers forget verses from the Bible. Hall of Famers fail to recognize themselves on trading cards. Outpatients get lost en route to the doctor. “A lot of ex-wives step in to help their ex-husbands,” says Culverhouse, who created the Players’ Outreach Program in Tampa Bay to provide health care and disability benefits for former players. She has an Ed.D. from Columbia University, a terminal illness, and a history of concussions from falling off too many horses. (She, too, has promised her brain to McKee.) Her clinic schedules appointments on Saturdays so players aren’t recognized. “One of the ex-wives set the GPS so her former husband could get to our medical center,” she says. Hours after his appointment, one of the nurses found him driving around the parking lot in circles. “No one had reset the GPS.”

With each new report about reckless, homeless, abusive players, drug addiction and suicide, McKee wonders: How much is attributable to brain disease and how much to the corrosive effect of celebrity and entitlement on a particular personality structure?

“There are horrible life changes in terms of memory, emotion, and lack of impulse control, which heaps gobs of negativity on them, divorce, addiction, businesses that fail,” Cantu says. “It’s a vicious cycle, a perfect storm. The final event for those that die young is not the brain damage per se but what the brain damage has led them to do, which is what caused Dave Duerson to put a gun to his chest.”

Duerson's last conscious act was to preserve his brain for science. That choice, Cantu says, also guaranteed a very painful death.

The most affecting of McKee's visual aids is a triptych she created documenting the progression of the disease. When she paints, she prefers oils, figurative painting. This digital portrait is deconstructed 21st-century abstract art.

The first panel, a slice of healthy brain tissue, reminds me of one in a series of Sam Francis paintings called "Blue Balls" but rendered in purples and whites. The second panel, a section of John Grimsley's brain, looks like a Jackson Pollock — Shimmering Substance, perhaps. The last panel from the boxer, who was her patient zero, calls to mind Willem de Kooning's Excavation.

The images have entered the public domain and the collective sporting unconscious thanks to permissions granted by family members. Still, Virginia Grimsley had the wind knocked out of her one day a year or so after her husband's death when she saw one of McKee's brain images flash across the TV screen: John's brain. She reminded herself — "It's good. It's all good. It has to come out."

Then she left a message for Nowinski. "You might want to warn the families."

Nowinski had hand-delivered John's slides to Houston in advance of the Family Conference, a conference call with family members during which she and Stern present their findings. Grimsley doesn't remember much from that time. Her synapses were snapped when her 45-year-old husband, a lifelong hunter, accidentally killed himself while cleaning a new gun. She now believes that he forgot that there were bullets in the chamber. She asked her boss, a pediatrician, to be on the call when she got the results from Stern and McKee. But it turned out Grimsley didn't need a translator because, she says, McKee is "so plain-English."

For McKee, the Family Conference is her first chance to fill the holes in the lives she sees under the microscope. For the wives, mothers, and daughters she calls "the crusaders," it is an opportunity to reclaim their loved ones from memories and reputations ravaged by disease.

"They're the only witnesses, which is also what intrigues Ann," Nowinski says. "The worst things are only seen by one person, and these stories never would see the light of day without them."

This is when she feels most like a clinician. "I'm being a doctor to people, but now the people are the families they've left behind."

She is asked "a million questions," Nowinski says, and stays on the line as long as there are answers she can give. "She allowed me to talk," Grimsley says simply. "I think she got a sense of who John was. This is not just brain tissue to her. This is someone's life, someone's memory, someone's husband, someone's son, someone's father."

After two and a half hours, Grimsley finally had a way to understand how a man who made his living as an outdoor guide ending up shooting himself to death. For the first time since his death in February 2008, she could exhale.

Tom McHale's slides arrived by mail at his widow's home along with a caution from McKee: "You might want to wait to open them until we are on the phone together."

Lisa McHale couldn't wait.

The impact was concussive. Her body shook. Her mind went blank.

McHale, who now works as a liaison between families and SLI, had been so sure they wouldn't find anything; so positive he had never suffered a concussion during nine years as an NFL offensive lineman. But doctors at the drug rehab center where he was treated for repeated relapse, depression, and irritability had no answers for them. "You seem to have embraced all that we have," a doctor told Lisa and Tom days before his death. "I've treated professional athletes before and I've had a similar problem, and I don't know what the problem is. Maybe it's the humility thing. Maybe you just can't reach that level of humility."

Lisa thought: You don't know my husband at all.

But she was no longer sure she ever knew him. Where was the sweet boy she met in college at Cornell? Who was this addict who used drugs with their three children in the house? Who succumbed to the overdose that killed him after Lisa told him he had to leave? Maybe I just remember Tom wrong, she thought. Maybe I glamorized him — because nobody's that good, and nobody changes that much.

After McKee presented her findings, McHale told her: "You gave me back my Prince Charming."

Sylvia Mackey heard from McKee and Stern two weeks before the Super Bowl in February, seven months after the death of her husband, John, the Hall of Fame tight end, no. 88 for the Baltimore Colts. She was the moving force in the creation of Plan 88, which pays \$88,000 a year toward the care of players with dementia, and she is still fighting for the benefits she and other widows are due. She wasn't apprehensive about receiving McKee's report — she was relieved that the results confirmed what she already knew inside. Her 45-year-old son cried.

She says the diagnosis of CTE and frontal temporal dementia explained John's fixation with what she calls his "man bag," a black leather shoulder bag he took everywhere, including to Bobby Mitchell's charity golf tournament in Washington, D.C. "You couldn't touch it," she says. "At a photo session, a lady reached for it and he pushed her back and cursed at her. It was the last time he was invited."

The bag contained the Sharpies he used to sign his autograph: John Mackey, no. 88. The prosaic tools of the celebrity trade were a reminder of who he had been. "We had to send that bag to the assisted living facility," she says. "Finally he forgot about it."

By then he couldn't remember anything at all.

On June 18, Eleanor Perfetto called Nowinski to make arrangements for her husband's brain to be delivered into McKee's care. Ralph Wenzel, who was 69, had been institutionalized since early 2007. Perfetto had long considered herself a widow.

Ralph disappeared little by little after being diagnosed with dementia in 1999. "One morning he got up and went into the bathroom before I could get him dressed," she says. "He came back and said, 'I need to get dressed. There are people in the bathroom.'"

Perhaps he was confused by his own nakedness. The doctors weren't sure.

By Christmas of 2006, belligerence had supplanted hallucination and delusion. He went to live in a lockdown facility. A month later, Perfetto and Wenzel gave an interview to Bernard Goldberg of HBO's Real Sports, though she did all the talking. By then, Wenzel, a high school physical education teacher in his second career, could barely speak. "He hadn't spoken the whole day," Perfetto says. "They probably filmed him six or seven hours. They were hauling the equipment out of the facility. He walked up to Bernie like he wanted to say something. Bernie said, 'Yes, Ralph, what is it?'"

"Ralph looked at him very seriously and he said, 'The kids. The kids.'"

Ann McKee doesn't sleep.

"How could she?" Mackey says.

Complete brain rest, the prescription for concussed athletes, is not an option for her. "I wake up in the middle of the night and I work," she says. "I get up and write part of a grant proposal. I dream about their slides. I dream about their lives. I can't put this to bed."

Painting is her refuge — the one place in her life that tau has not infiltrated. She works with a private instructor at an art studio and tries to get there twice a week. "The reason I love art is if you're really painting you are not thinking about this," she says, nodding at an example of brain portraiture. "You have to completely spiral your brain in a different direction. Once you get into that zone, you're resting your brain. I still struggle with this work being very analytical and art being very non-analytical. So to put the two together is a real brain cramp."

She says her house and garden are a wreck. She's embarrassed to have people over. Nowinski sees the toll elsewhere. "She covers it up incredibly well in public," he says. "But there's times she talks about how this research is slowly killing her."

In October 2011, McKee and Kevin Turner were honored at the fourth annual SLI Impact Awards dinner in Boston for their work on behalf of brain-trauma awareness. Turner, a college star for the Crimson Tide and fullback for the Patriots and Eagles, was embarrassed to share the award with her. "What did I do?" he says. "I just got diagnosed with ALS."

Turner, the subject of a new documentary, *American Man*, was diagnosed with amyotrophic lateral sclerosis — Lou Gehrig's disease — in May 2010. Two months later, McKee published a study linking traumatic brain injury with an ALS-type disease, which she has subsequently documented in 11 athletes, amateur and professional.

Turner was among 40 to 50 athletes at the banquet who had promised their brains to McKee. But unlike most of them, he is unlikely to survive her tenure at the Brain Bank. As he accepted a hug and a plaque, he knew that the woman with whom he shared the podium and an embrace will someday receive a Styrofoam box containing his brain and spinal cord. "I want her to use it all," he says.

The guests included family members of traumatic brain injury victims — Perfetto, McHale, and Mackey among them — and athletes of every age and pursuit. "Most were men, and they wanted to meet her because to them, she's a rock star," Nowinski says. "She's the person they're trusting their legacy to. They trust her to take care of their brain and how they're remembered. So I had everybody line up in a

receiving line as she went up to the podium to accept the award. Everybody cried. Everybody got a hug.”

I reached Kevin Turner in his pickup truck at a fast-food drive-in in Birmingham, Alabama. He was grabbing a sandwich en route to his younger son’s basketball game. He pulled his boys out of football after listening to Cantu explain the vulnerability of the brain between ages 6 and 14, which made him less popular than he once was in Birmingham. He will allow his older son, Nolan, to return to the field this fall for freshman year in high school once he turns 15. “My youngest, he’s 8,” he says. “He doesn’t know it yet, [but] he’s going to take a break until high school.”

By the time I caught up with Turner again six months later, Cole had turned 9 and was complaining bitterly about playing flag football instead of “real football.” Things had gotten harder for his father too. He can no longer zip his pants or get himself a glass of water or reach into his pocket for his wallet. (He carries a bag now.) His sons know where he keeps the credit cards. They pump the gas and help change the gearshift when dad is driving, as he was when I reached him again.

He pulled over so we could talk, and a police officer stopped to make sure he was OK. Turner told him he was fine. “I can still breathe, so I can’t complain,” he says.

He still lives alone but is looking to hire someone to be his hands. He can’t rely on his daughter and sons anymore. He doesn’t go out to eat much. It’s hard to get a fork in his mouth, to get to the bathroom in time, to change the channel on the remote, to answer the telephone. A lot of calls go unanswered.

In June, talking was a problem. It’s better now. “One day it felt like there was something in my mouth. I was trying to spit it out,” he says. “It felt like I had just come out of the dentist. I couldn’t feel my lips.”

Turner told me in February that he hoped to visit McKee’s lab to see where the work is done. He wondered “what they’ll be saying when they’re digging into my head — ‘here’s one of his dumb jokes. We need to take that part out.’”

He also said he was worried that knowing him will make McKee’s job more difficult. He wants to have a conversation with her, perhaps in September when he is scheduled to attend a conference in Boston on traumatic brain injury and ALS. “I think I know what I’m going to say,” Turner told me. “I’d hope I’d say, ‘I’m so happy it’s in your hands. I want you to be smiling and thinking about how much fun I had my whole life.’ I don’t want her to have a bad day at the office.”

EXHIBIT 3

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NY Giants' Steve Tisch Reveals His \$10M Plan to Further Concussion Research

7:00 AM PST 09/11/2014 by Rebecca Sun

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Smallz & Raskind

In THR's Top Doctors Issue, the NFL team's owner, who is supporting UCLA's BrainSPORT Program, and Dr. Christopher Giza explain the plan to help young athletes

This story first appeared in the Sept. 19 issue of The Hollywood Reporter magazine.

As co-owner of the New York Giants, **Steve Tisch** is attuned to the dangers surrounding **concussions in the NFL**. But the Oscar-winning producer also cares deeply about the risks facing young athletes, which is why in May he pledged \$10 million to UCLA's BrainSPORT Program for concussion research, with a focus on the millions of youth who play sports. "If coaches get state-of-the-art information about how to recognize a head injury and how to treat it, it's very comforting as a parent," says Tisch, 65, whose daughter **Holden, 14, sustained a concussion** last year playing lacrosse.

Dr. **Christopher Giza**, the program's director, notes that the young brain continuously is evolving. "If it gets damaged and is not allowed to recover, that development is going to go off the tracks," he says. "The goal is to figure out the differences between concussion in kids and adults and then develop individualized

treatment plans for the young athletes." With Tisch's gift, which Giza calls "transformative," BrainSPORT will baseline test athletes from middle school to college and create diagnostic tools precisely calibrated for age and gender. Dr. **Neil Martin**, UCLA's chair of neurosurgery, adds that the program will finally locate definitive answers to long-asked questions: "How many concussions are too

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By addressing these issues early, Tisch believes pro football's future will benefit as well. "Our players start when they're 8, 12 years old," says Tisch, whose donation is the most an individual ever has given for the **study of concussions**. "Hopefully my gift to UCLA will inspire other NFL owners to do something similar. This is good for everybody."

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Comments

EXHIBIT 4

ImPACT Test

ImPACT Founders

ImPACT Applications, Inc., is based in Pittsburgh, Pennsylvania and was co-founded by Mark Lovell, Ph.D., Joseph Maroon, M.D., and Michael (Micky) Collins, Ph.D. in 2002. The science behind ImPACT was developed in response to requests for neurocognitive testing from the NFL to help determine safe return to play. The ImPACT Concussion Management Model was first put into use in 1997. Today, ImPACT is constantly updating products, services and its training programs by integrating new technologies, input from experts and users, and ongoing research on concussion rehabilitation methods.



Mark Lovell, Ph.D.

Mark R. Lovell, Ph.D., is internationally recognized as a concussion expert for his development of innovative neurocognitive testing programs and ground breaking research. Dr. Lovell served as the Chairman and Chief Executive Officer of ImPACT Applications from 2002 through 2013, and currently serves as Chairman of the Board and Chief Scientific Officer. In the early 1990's he developed the ImPACT® Test which is the first, most-widely used and most scientifically validated computerized concussion evaluation system. The ImPACT Test has become an internationally used tool in the comprehensive clinical management of concussions. Dr. Lovell's expertise led to his development and direction of the first league wide neuropsychological testing programs for the National Football League (NFL) and National Hockey League (NHL). Dr. Lovell remains a neuropsychological consultant for several organizations throughout the world including, but not limited to, the NFL Players Association, NHL, Irish Rugby, USA Women's Olympic Hockey team, World Wrestling Entertainment (WWE) and the US Ski and Snowboard team.

In 2000 Dr. Lovell became the founding director of the University of Pittsburgh Medical Center's (UPMC) Sports Medicine Concussion Program. Dr. Lovell's pioneering approach to concussion management attracted professional athletes from around the world to the UPMC Concussion Program. Until his retirement from clinical practice in 2011, Dr. Lovell directed the UPMC program, which has been regarded as the first and largest program of its kind.

Dr. Lovell is a leader in concussion research, publishing over 100 peer-reviewed articles, authoring or co-authoring nine textbooks and writing over 40 book chapters. He is an instrumental force in spreading concussion education and awareness among the public and medical community. Dr. Lovell served as a panel member for the Center for Disease Control's Coaches Toolkit and has trained thousands of medical professionals on neurocognitive testing and concussion management. Dr. Lovell's contributions to the neuropsychological community have allowed him to be a frequent presenter at professional meetings internationally and serve as a member of the Vienna and Prague

International Consensus Conference on Sports-Related Concussion.

His vast accomplishments include the Council of Brain Injury Award for Excellence, National Concussion Summit Excellence in Safety Award, USA Hockey Excellence in Safety Award, American Board of Professional Neuropsychology Distinguished Clinical Neuropsychologist Award and most recently his alma mater, Northern Michigan University, awarded him with an Honorary Doctor of Science degree for his pioneering work in managing sports concussions.

Dr. Lovell is a member of various professional and scientific organizations including the International Neuropsychological Society, American Psychological Association and North American Brain Injury Association. In addition to being a member of several prestigious organizations, Dr. Lovell has been a reviewer for over 15 professional journals and is currently serving as an editorial board member for several different journals.



Joseph Maroon, M.D.

Joseph Maroon, MD, FACS is professor and Vice Chairman of the Department of Neurological Surgery and Heindl Scholar in Neurosciences at the University of Pittsburgh School of Medicine. He is regarded as a premier specialist in the surgical treatment of injuries and diseases of the brain and spine, particularly with microscopic and minimally invasive procedures. His research into brain tumors, concussions and diseases of the spine has led to many innovative techniques for diagnosing and treating these disorders. Dr. Maroon has published over 270 papers and is on the editorial boards of Surgical Neurology International, The Physician and Sportsmedicine, and Neurological Research. He is consistently listed in America's Best Doctors and he has an international patient clientele.

He has been the team neurosurgeon for the Pittsburgh Steelers since 1981 and the medical director for World Wrestling Entertainment Corporation since 2006. He has successfully performed surgery on numerous professional and elite athletes with potentially career ending spine injuries. He has also served on the National Football League's Head, Neck and Spine Committee since 2007.

Along with Mark Lovell, Ph.D., in the early 1990's Dr. Maroon co-developed ImPACT® (Immediate Post Concussion Assessment and Cognitive Testing); the first, most-widely used and most scientifically validated computerized concussion evaluation system.

As an avid athlete himself, he has completed over 70 triathlons, seven of these Ironman distance races in Hawaii, Europe, New Zealand and Canada. Dr. Maroon is frequently quoted as an expert source by national media including the *New York Times*, *USA Today*, *Associated Press*, *ESPN*, *Sports Illustrated* and *ABC News Nightline*.



Micky Collins, Ph.D.

Michael "Micky" Collins, Ph.D., is an internationally renowned expert in sports-related concussion. A leading clinician and researcher, Dr. Collins serves as the clinical and executive director and a founding member of the UPMC Sports Medicine Concussion Program. Established in 2000, it was the first program of its kind; more than a decade later, it remains the largest research and clinical program focused on the assessment, treatment, rehabilitation, research and education of sports-related mild traumatic brain injury in athletes of all levels.

Dr. Collins' expertise attracts elite and professional athletes from around the world seeking the comprehensive care he provides and the multidisciplinary approach he helped to introduce. On a daily basis, Dr. Collins and his UPMC program colleagues see dozens of patients – embodying youth, high-school, collegiate and pro athletes -- with concerns about safe return to play and return to school/work following treatment and rehabilitation.

Besides his extensive clinical experience, Dr. Collins also has been a lead author and investigator on numerous groundbreaking studies of high-school and college athletes published in *JAMA*, *Neurosurgery*, *American Journal of Sports Medicine* and *Pediatrics*, among others. He has been the lead author or co-author on more than 60 peer-reviewed research articles in medical journals and has delivered more than 250 presentations at national and international scientific meetings. National and local media often interview him as an expert source.

Dr. Collins has been an instrumental source across the nation in developing concussion-management policy in youth sports, return-to-play laws and the Centers for Disease Control's concussion toolkit. He is a co-founder of ImPACT® (Immediate Post-Concussion Assessment and Cognitive Testing). As a result, he is a leader in educating and implementing the proper usage of such baseline and post-injury neurocognitive testing as one tool to help determine an injury's severity and recovery for safe return to play.

In addition to training thousands of physicians and certified athletic trainers in the diagnosis and management of sports-related concussion, he advises numerous athletic organizations and teams – including several major-college programs (Florida, Florida State, Louisiana State and Michigan State to name a few), the NFL Steelers, the NHL Penguins, numerous MLB clubs, MLB Umpires, USA Rugby and Cirque De Soleil. He also serves as a consultant or on the editorial board of such publications as *Brain Injury Professional*, *Journal of Athletic Training* and the *Journal of Sports Neurology*, where he is Associate Editor.

A graduate of the University of Southern Maine with a bachelor's degree in psychology and biology in 1991, Dr. Collins earned a master's degree in psychology in 1995 and doctorate degree in clinical psychology in 1998 at

Michigan State University. Among numerous national and international honors over the past decade, Dr. Collins in 2010 received the National Council on Brain Injury annual award for outstanding research and advocacy. In 2009, he was bestowed the Kenneth L. Knight Award for outstanding research. An athlete himself, Dr. Collins played for the University of Southern Maine in the 1989 NCAA Baseball College World Series and trained to run in the 2012 Pittsburgh Marathon.

EXHIBIT 5



ESPN.com: NFL

[\[Print without images\]](#)

Thursday, August 9, 2007
Updated: August 10, 5:29 PM ET

NFL's concussions expert also sells equipment to league

By Peter Keating
ESPN The Magazine

The National Football League's director of neuropsychological testing is also the chairman of a company that sells testing software to NFL teams, a dual role which raises questions about conflicts of interest.

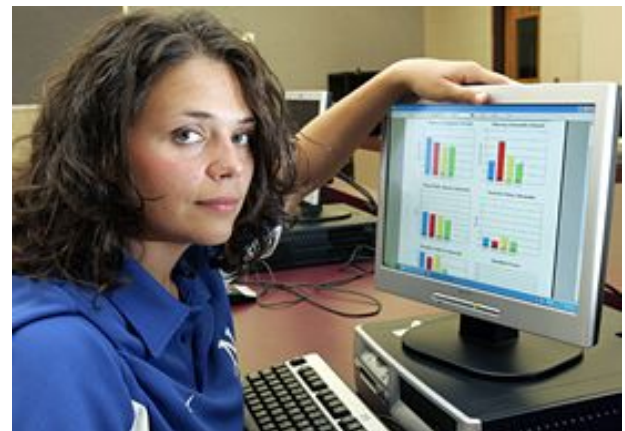
Mark Lovell, director of the Sports Concussion Program at the University of Pittsburgh Medical Center, oversees neuropsychological testing programs for the NFL. In that capacity, he has helped teams use neurocognitive tests -- which essentially grade subjects on their memory and reaction time -- to help team doctors make decisions about when injured athletes can return to play. This season, baseline neuropsychological tests will be mandatory for all NFL players for the first time.

In the late 1990s, Lovell and Joseph Maroon, clinical professor of neurological surgery at the University of Pittsburgh and team neurosurgeon for the Pittsburgh Steelers, developed their own computer-based battery of tests, calling it the Immediate Post-Concussion Assessment and Cognitive Testing (ImPACT) system. Together with Michael Collins, assistant director of the Sports Concussion Program at Pittsburgh, they launched a company called ImPACT Applications to make their product commercially available. Today, Lovell is chairman and software developer at ImPACT Applications, Collins is chief clinical officer and Maroon is chief medical officer.

At the same time, Lovell and Maroon are members of the NFL's Committee on Mild Traumatic Brain Injury (MTBI), which conducts research projects designed to help the league better understand and manage concussions.

Lovell is also a consultant to the Steelers, and oversees neuropsychological testing programs for the Indianapolis Racing League (IRL) and CHAMP Car Racing. From 1997 to 2007, he co-directed the National Hockey League's neuropsychology program.

Lovell's overlapping roles and financial interest in ImPACT have drawn criticism from several doctors and athletic trainers working in the field of sports concussions. Their ire has intensified as Lovell sometimes has not identified himself as one of ImPACT's developers in his scientific research. On at least seven occasions since 2003, Lovell has authored or co-authored studies on neuropsychological testing, including papers directly evaluating ImPACT, without disclosing his roles in creating and marketing ImPACT, according to an ESPN.com review of recent medical literature. In one case, an examination of Lovell's connections prompted an academic journal to rewrite its disclosure guidelines for authors.



ImPACT is used by trainer Erin Cearfoss last August at Northern Burlington County Regional High School in New Jersey.

"It is a major conflict of interest, scientifically irresponsible," says Christopher Randolph, professor of neurology at Loyola University Medical Center in Chicago and former team neuropsychologist for the Chicago Bears. "We are trying to get to what the real risks are of sports-related concussion, and you have

to wonder why they are promoting testing. Do they have an agenda to sell more ImPACTs? And if you're writing a paper and you have anything to do with a company involved, it's imperative that you disclose it."

Earlier this year, NFL commissioner Roger Goodell ordered all teams to implement baseline neuropsychological tests. ImPACT, which is one of a handful of computerized neuropsychological systems available (CogSport, the Concussion Resolution Index, and the Automated Neuropsychological Assessment Metrics are among the others) has since become the league's *de facto* standard testing system. Thirty of the NFL's 32 teams now use ImPACT, according to the company's Web site.

"I can see why the league would want one standardized test," says a leading neurosurgeon, who asked to remain anonymous because his patients include former NFL players. "I can't for the life of me understand why they would want that standard to be a test that is owned by two members of the [MTBI] committee."

Lovell declined to reply by e-mail or telephone to questions sent to him by ESPN.com. He also declined a request to be interviewed by "Outside the Lines."

"These are very important issues that are too complicated to address in an edited 10-second sound-bite," says Susan Manko, spokesperson for the University of Pittsburgh Medical Center.

In a statement to ESPN.com, NFL spokesman Greg Aiello said: "The commissioner is not expecting the committee to specifically recommend a single neuropsych[ological] testing protocol. Most of the clubs have already decided to use the ImPACT test on their own, or were already using it. There are many members of the committee who have had no role in developing ImPACT and no financial interest in it. And ImPACT has been the subject of a good deal of independent study."

Scientists are currently debating how useful ImPACT and other computerized systems are in diagnosing concussions. Citing multiple studies, Lovell and his colleagues have stated that "ImPACT has been shown to be an effective tool for concussion management." They have asserted repeatedly that ImPACT measures real effects, not just the ability of subjects to improve on tests with practice, and that it can discern even mild concussions.

But almost all of the research supporting ImPACT has been written or co-written by its inventors. For example, Lovell and Collins are co-authors of all 19 of the publications listed in the "Reliability and Validity" section on the ImPACT Web site. "I think ImPACT is a good system, and we use it at West Virginia," says Julian Bailes, chairman of the neurosurgery department at West Virginia University and medical director for the Center for the Study of Retired Athletes. "Most of the studies on ImPACT, however, have been by the people who developed it. Some of that is inevitable, because we are still relatively early in the process of trying to validate it."

In 2005, the Journal of Athletic Training published a study co-written by Loyola's Randolph that surveyed the preceding 15 years of medical literature on neuropsychological testing. It found: "Only one peer-reviewed article involving a prospective controlled study with ImPACT has been published."

More recently, independent research has cast doubt on the overall value of computerized testing. In a study that will be published later this year in

Outside the Lines

On Sunday, ["Outside the Lines"](#) will examine the journeys of two men who have become unlikely partners in the common belief that brain damage from repeated concussions in football can lead to depression, dementia and suicide. One is a former pro athlete whose career was ended by concussions; the other is a doctor who worked on the autopsies of two former NFL players.

In addition, "Outside the Lines" takes a close look at

the Journal of Athletic Training, researchers gave computerized tests to a group of uninjured college students, then tested them again 45 days later. ImPACT incorrectly identified the subjects as having some aspect of a concussion in 38.4 percent of cases. "We tested three computerized systems and found all of them to be less than optimal," says Steven Broglio, lead author of the study and professor of kinesiology at the University of Illinois at Urbana-Champaign. Broglio declined to elaborate on the data because it has yet to be published, and did not supply it to ESPN.com. But he confirmed that it was presented to NFL team doctors and athletic trainers at the concussion summit the league held on June 19 in Chicago.

"Neurocognitive testing is only one tool for assessing injuries," Broglio says. "Athletes can also be evaluated according to their symptoms and their postural control, meaning how well they maintain their balance. Our published research has found that when you look at all three, computerized tests have about the same sensitivity to concussions as paper-and-pencil tests."

Traditional paper-and-pencil tests gauge the subject's memory by methods such as asking for recall of word lists, and the subject's processing speed by measures such as using a key to coordinate symbols with numbers in a series of fill-in boxes on a page.

The computerized systems such as ImPACT basically adapt the same sorts of testing procedures to a machine.

"I have a lot of concern with ImPACT, as I still have not seen a good study of basic psychometric properties that suggest ImPACT is as good or better than paper-and-pencil tests," says one veteran NFL team neuropsychologist, who did not want to be identified as publicly criticizing Lovell or the NFL. "Computer tests look cool on the screen and seem very sophisticated, but they are really just fancy stopwatches." Among neuropsychologists' worries: differences in computer architecture and hardware (such as whether the software is running on a desktop or a laptop), the possibility that other applications are open and how a subject uses his computer's mouse all could affect the accuracy of ImPACT's timing measurements.

Nevertheless, Lovell's company, ImPACT Applications, is aggressively and successfully marketing its software. ImPACT is a private company and does not disclose its annual revenue or profits. But the firm, which is based in Pittsburgh, has sales representatives as far away as Australia and South Africa. It sells desktop and online versions of ImPACT to organizations and schools in packages ranging in price from \$500 to \$1000 per year, plus extra charges for additional tests. It also holds training workshops, charging doctors and athletic trainers from \$100 to \$200 to attend daylong seminars in Pittsburgh. Sessions include "Development of ImPACT," "On-Field Management of Concussion" and "Question and Answer Forum on the ImPACT Test, Marketing Your Services and Using the Media to Promote Your Sports Concussion Practice," according to a sample agenda on the company's Web site. An Aug. 3 workshop was filled, with 24 participants; ImPACT is now accepting registrations for another seminar series on Sept. 21.

But readers of Lovell's academic work will find scarce mention of these business activities, even in research he has conducted on ImPACT itself.

In the March 2006 edition of Brain Injury, for example,

Mark Lovell's ImPACT test and its use by the NFL, and explores whether it is good science to have a member of the league's concussions committee analyzing data and helping set policy using a product in which he has a financial interest.

Guests include Garrett Webster, the son of late former NFL center Mike Webster; and ESPN The Magazine's Peter Keating. "Outside the Lines" is hosted by Bob Ley. Tune in Sunday at 9:30 a.m, ET, on ESPN.

Lovell and three co-authors described ImPACT as a "brief computer-administered neuropsychological test battery" without detailing its origins. The acknowledgments to that study contained the equivalent of an advertisement for the software: "Additional information on ImPACT is available at www.impacttest.com."

After receiving a complaint about that paper and another co-authored by Lovell last year, the editorial board of Brain Injury decided to require researchers to state more fully any possible conflicts of interest. "We share your concern ... Your letter has inspired us to develop a fair and appropriate policy which will be communicated to our authors," Jeffrey Kreutzer, editor of Brain Injury, wrote on April 4, 2006, to a reader who had expressed concerns about Lovell and ImPACT.

"Some of the people publishing on neuropsychological testing had a financial interest in it," Kreutzer, who is also a professor of physical medicine and rehabilitation, neurosurgery and psychiatry at the Virginia Commonwealth University Medical Center, says today. "So we spiffed up our disclosure policy."

In the January 2006 issue of the British Journal of Sports Medicine, a study by Lovell and three other researchers found that athletes with one or two prior concussions did not differ significantly from athletes with no prior concussions in their performance on ImPACT tests. The authors rejected the idea that the results could have stemmed from any flaws in ImPACT: "The failure to detect possible persisting problems from one or two previous concussions is probably not due to inadequate sensitivity of the computerised screening measure."

The conclusion of that paper listed "competing interests" of the authors. It read: "None declared."

"I was responsible for the Web-based electronic submission of this article," says Grant Iverson, professor of psychiatry at the University of British Columbia and a co-author of the paper. Iverson contacted ESPN.com at Lovell's request. "If mistakes were made therein, they were my fault," he says.

Potential conflicts of interest have cropped up even in research where Lovell has revealed his involvement with ImPACT. In the February 2006 issue of Neurosurgery, Lovell and three members of the MTBI Committee published a study that used ImPACT test scores to look at how NFL and high school athletes recovered from concussions. The acknowledgments to that paper stated: "Dr. Lovell has a financial interest in the ImPACT computer based neuropsychological test battery used by many NFL teams."

But in the peer reviews immediately following the paper, the first two commenters were Collins and Maroon, Lovell's fellow corporate officers at ImPACT Applications. They lauded ImPACT, writing: "We think that computerized neuropsychological testing as outlined in this study will become the standard of care to assist physicians with their clinical judgment in assessing and managing athletes with mild traumatic brain injury."

Their roles in developing and marketing ImPACT were not disclosed.

Peter Keating writes about sports business for ESPN The Magazine.

Roger Goodell



NFL commissioner Roger Goodell has mandated baseline neuropsychological testing for all players for the first time this season.

EXHIBIT 6

Advances and Controversies in Neuropsychological Assessment

Grant L. Iverson, Ph.D

Department of Physical Medicine and Rehabilitation

Harvard Medical School

&

Red Sox Foundation and Massachusetts General Hospital Home Base Program

7-Year Funding Disclosure

- Canadian Institute of Health Research
- Lundbeck Canada, AstraZeneca Canada, Pfizer Canada
- ImPACT Applications, Inc. (past research support)
- CNS Vital Signs (past research support)
- Psychological Assessment Resources, Inc. (past support)
- Tampere University Hospital
- Roche Diagnostics Canada
- Alcohol Beverage Medical Research Council
- Defense and Veterans Brain Injury Center
- Vancouver Coastal Hospital Health Research Institute
- Red Sox Foundation and Massachusetts General Hospital Home Base Program

Topics

- Self-Reported Symptoms
 - Nonspecific
 - “Good Old Days” Bias
 - Exaggeration
- Cognitive Testing
 - Accuracy and Specificity
 - Prevalence of Low Scores in Healthy People
 - New Algorithms for Identifying Cognitive Impairment

#1

Neuropsychological assessments rely on
(1) self-reported symptoms, and (2)
cognitive testing.

Are long-term symptoms caused by the
original injury, other factors, or both?

Post Hoc Ergo Propter Hoc

- After this therefore because of this
 - A. MTBI in accident
 - B. Symptoms reported two years later
- A caused B. Therefore, symptoms are due to MTBI (by inference, due to brain damage)

“Postconcussion-Like” Symptoms are Common

University students

Mental health outpatients

General medical patients

Chronic pain patients

Personal injury litigants

Applied Neuropsychology
2003, Vol. 10, No. 3, 137–144

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Lawrence Erlbaum Associates, Inc.

Examination of “Postconcussion-Like” Symptoms in a Healthy Sample

Grant L. Iverson

University of British Columbia & Riverview Hospital, Vancouver, British Columbia, Canada

Rael T. Lange

University of British Columbia, Vancouver, British Columbia, Canada

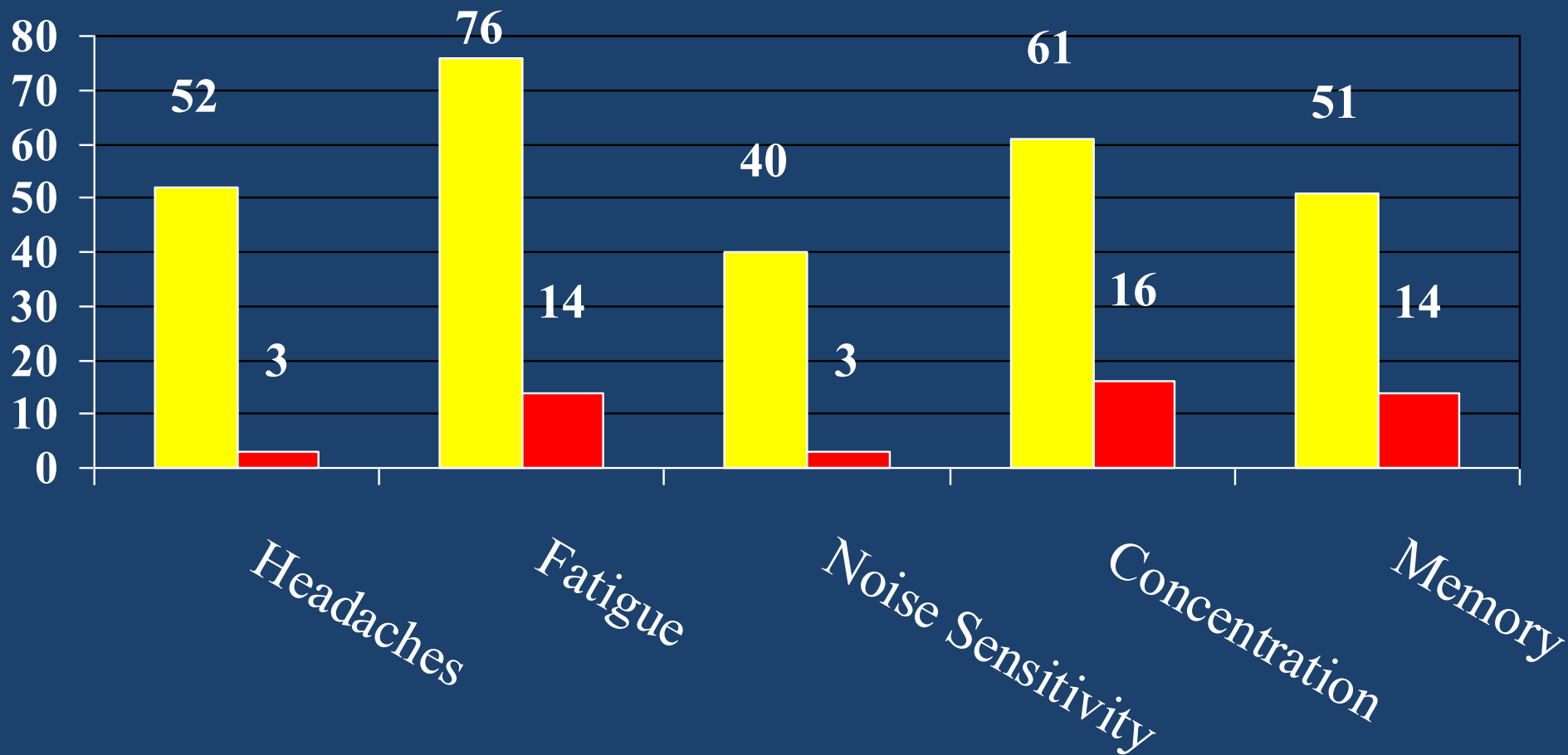
PCS-Like Symptoms in Community Volunteers

- 104 community control subjects from the greater Vancouver area
- Exclusion criteria: (a) previous mental health problem, (b) brain injury, (c) neurological disorder, (d) substance abuse.
- All completed a PCS checklist patterned after the ICD-10 Criteria.

Iverson & Lange (2003)

PCS-Like Symptoms in Community Controls

(Yellow = Mild; Red = Mod-Severe)

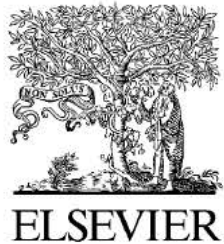


DSM-IV Diagnosis of Postconcussional Disorder

79.6%

Moderate – Severe Symptom Endorsement

14.6%



Archives of Clinical Neuropsychology 21 (2006) 303–310

Archives
of
CLINICAL
NEUROPSYCHOLOGY

Misdiagnosis of the persistent postconcussion syndrome in patients with depression

Grant L. Iverson*

Department of Psychiatry, University of British Columbia & Riverview Hospital, 2255 Wesbrook Mall, Vancouver, BC V6T 2A1, Canada

Accepted 14 December 2005

Misdiagnosis of PCS in Depression

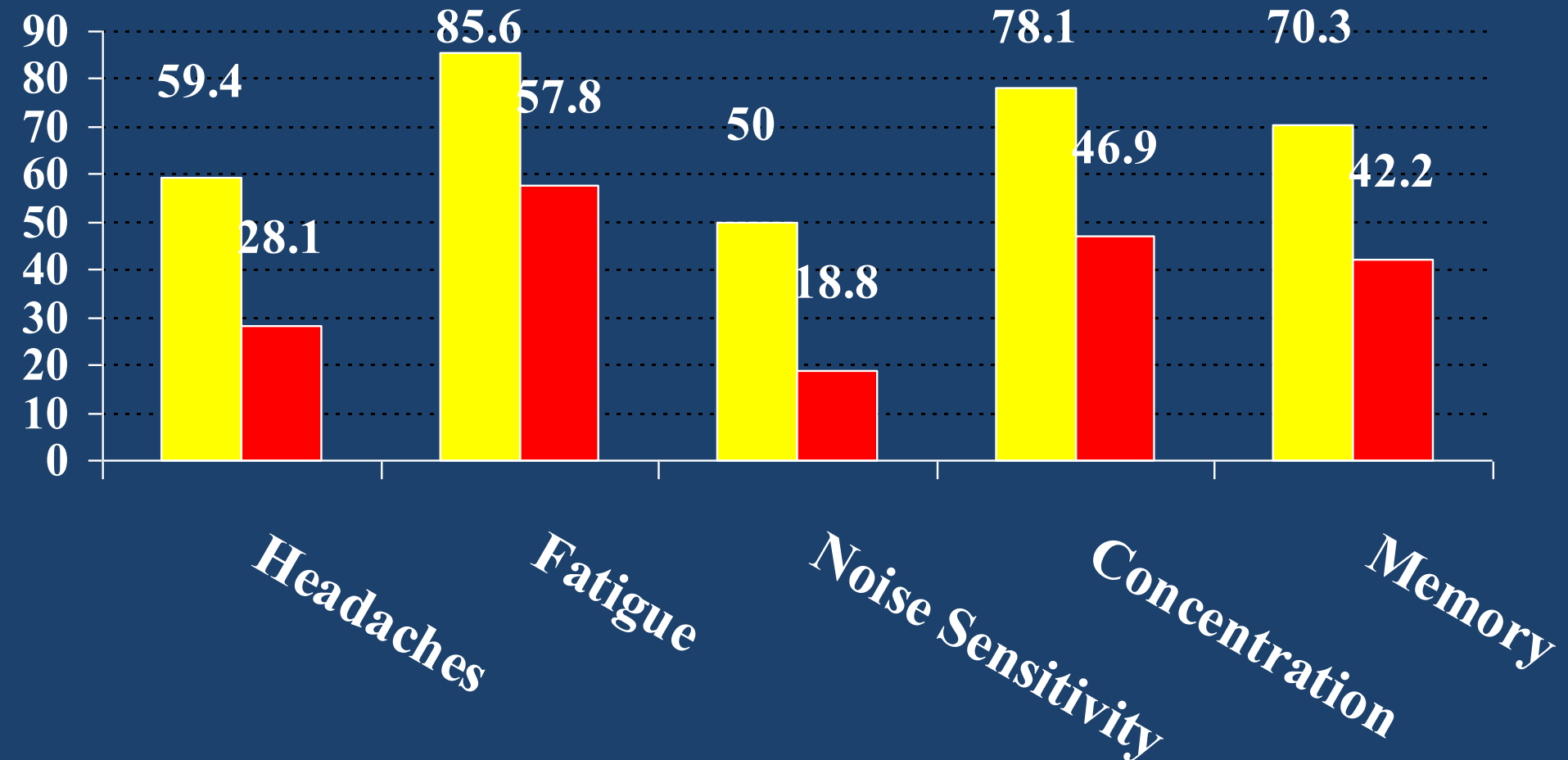
- 64 patients with depression
- Diagnosed and referred by family physician or psychiatrist
- Independently confirmed diagnosis with SCID-I

Iverson (2006)

Case 13.2-mil-92233-AB Document 645-13 Filed 12/02/14 Page 45 of 95

PCS-Like Symptoms in Patients with Depression

(Yellow = Mild; Red = Mod-Severe)



DSM-IV Diagnosis of Postconcussional Disorder

85.9%

Moderate – Severe Symptom Endorsement

53.1%

#2

Some people look back on their past
with “rose-colored glasses”

Or misrepresent past symptoms and
problems

The Clinical Neuropsychologist, 2009, 1–21, iFirst

<http://www.psypress.com/ten>

ISSN: 1385-4046 print/1744-4144 online

DOI: 10.1080/13854040903190797

 **Psychology Press**
Taylor & Francis Group

“GOOD OLD DAYS” BIAS FOLLOWING MILD TRAUMATIC BRAIN INJURY

**Grant L. Iverson¹, Rael T. Lange², Brian L. Brooks³,
and V. Lynn Ashton Rennison⁴**

¹University of British Columbia and British Columbia Mental Health & Addiction Services, Vancouver, BC, ²British Columbia Mental Health & Addiction Services and University of British Columbia, Vancouver, BC, ³Alberta Children's Hospital and University of Calgary, Calgary, AB, and ⁴Fraser Health Authority Concussion Clinic and Royal Columbian Hospital, Vancouver, BC, Canada

Good Old Days Bias

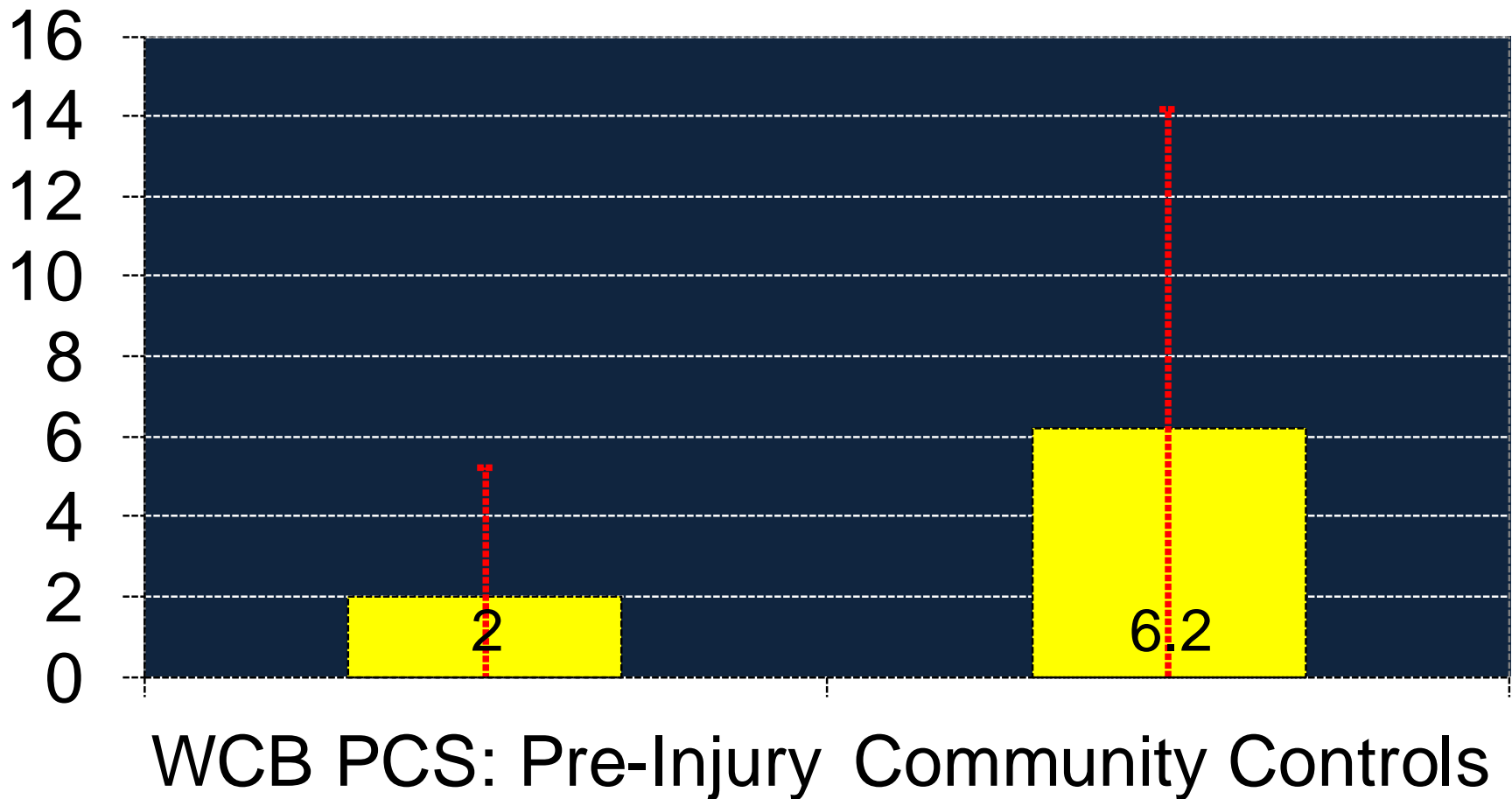
- The tendency to view oneself as healthier in the past and under-estimate past problems is referred to as the “good old days” bias.
- Researchers have reported that some patients with a history of MTBI and/or who are involved in litigation report fewer symptoms and problems than healthy adult control subjects.

Retrospective vs. Current Symptom Ratings

- WCB patients with Post-Concussion Syndrome (N=90) asked to retrospectively rate their pre-injury symptoms
- Healthy controls and university students (N=177) asked to rate their current symptoms

Iverson, Lange, Brooks, & Ashton (2010)

Pre-Injury Retrospective Symptom Reporting vs. Current Symptom Reporting



#3

Some people exaggerate symptoms
and/or deliberately under-perform on
neuropsychological testing

Relation Between Poor Effort & Symptom Reporting

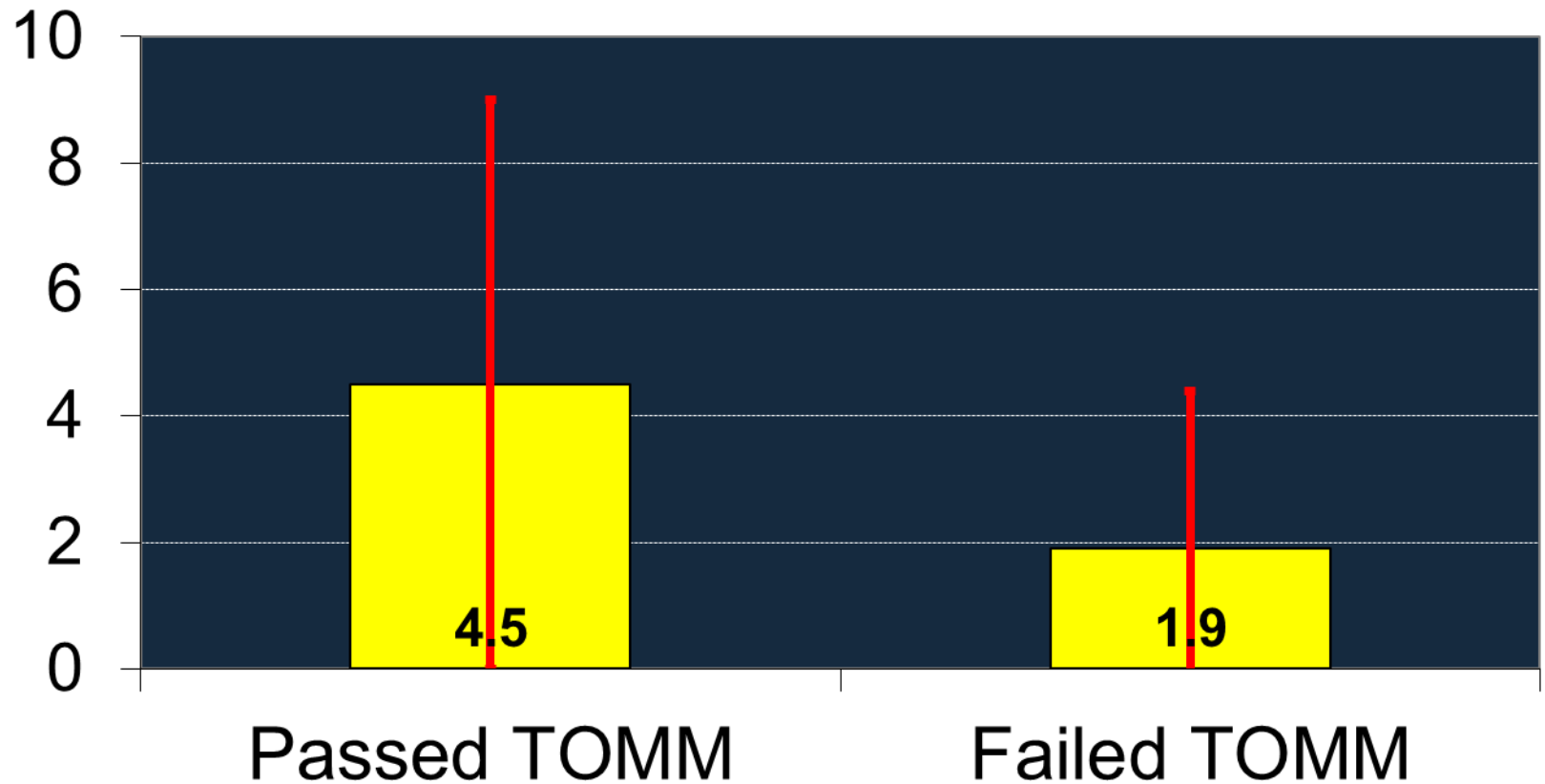
- Worker's Compensation Patients
- N=59
- All with MTBIs
- Age = 42.3 (SD = 11.7)
- 68% Men; 32% Women
- 1.9 Months Post Injury (SD = 1.0)

Test of Memory Malinger (TOMM)

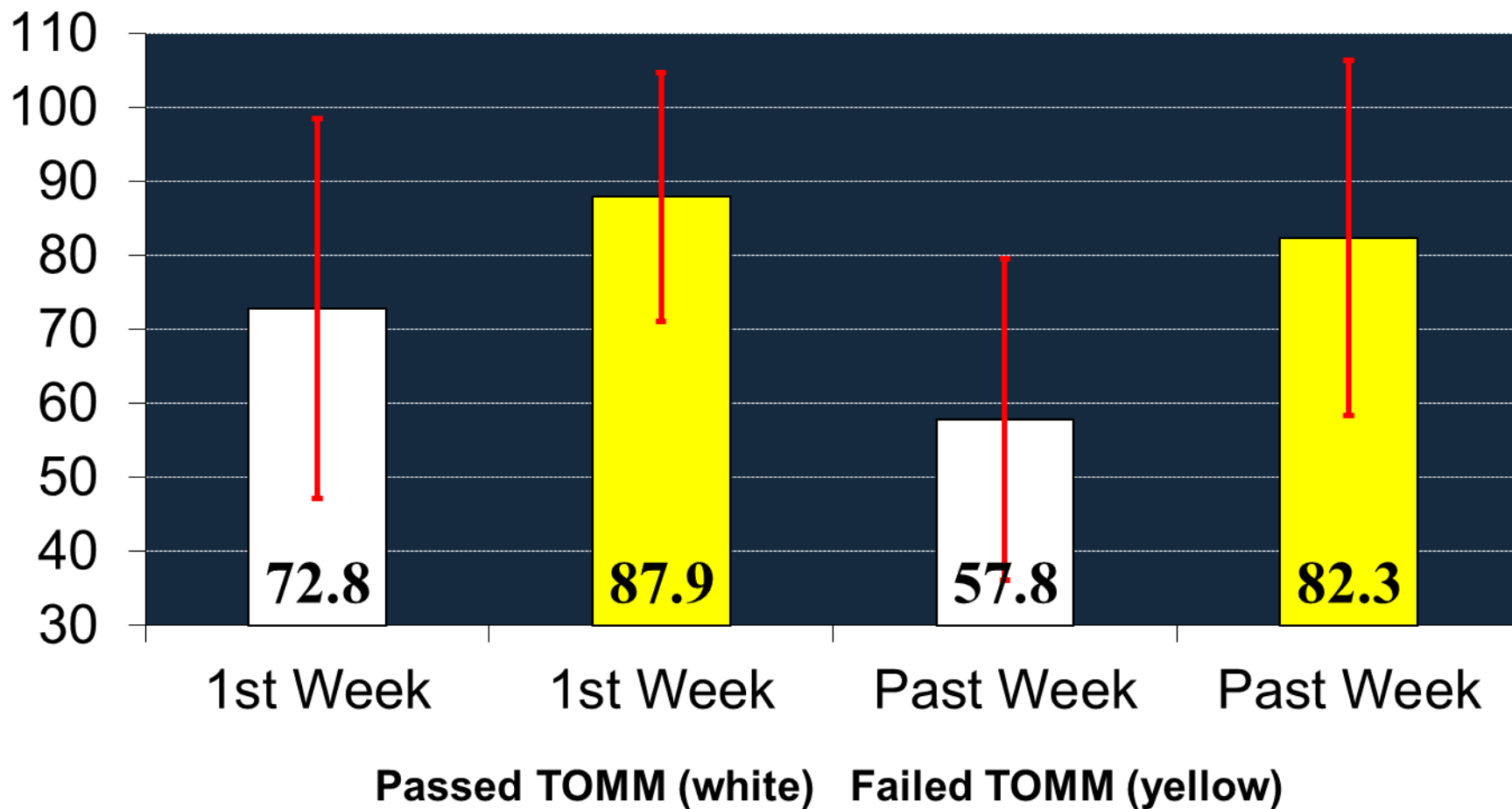
Effort Test

25% Failed

Pre-Injury Symptom Ratings



Total Symptom Reporting

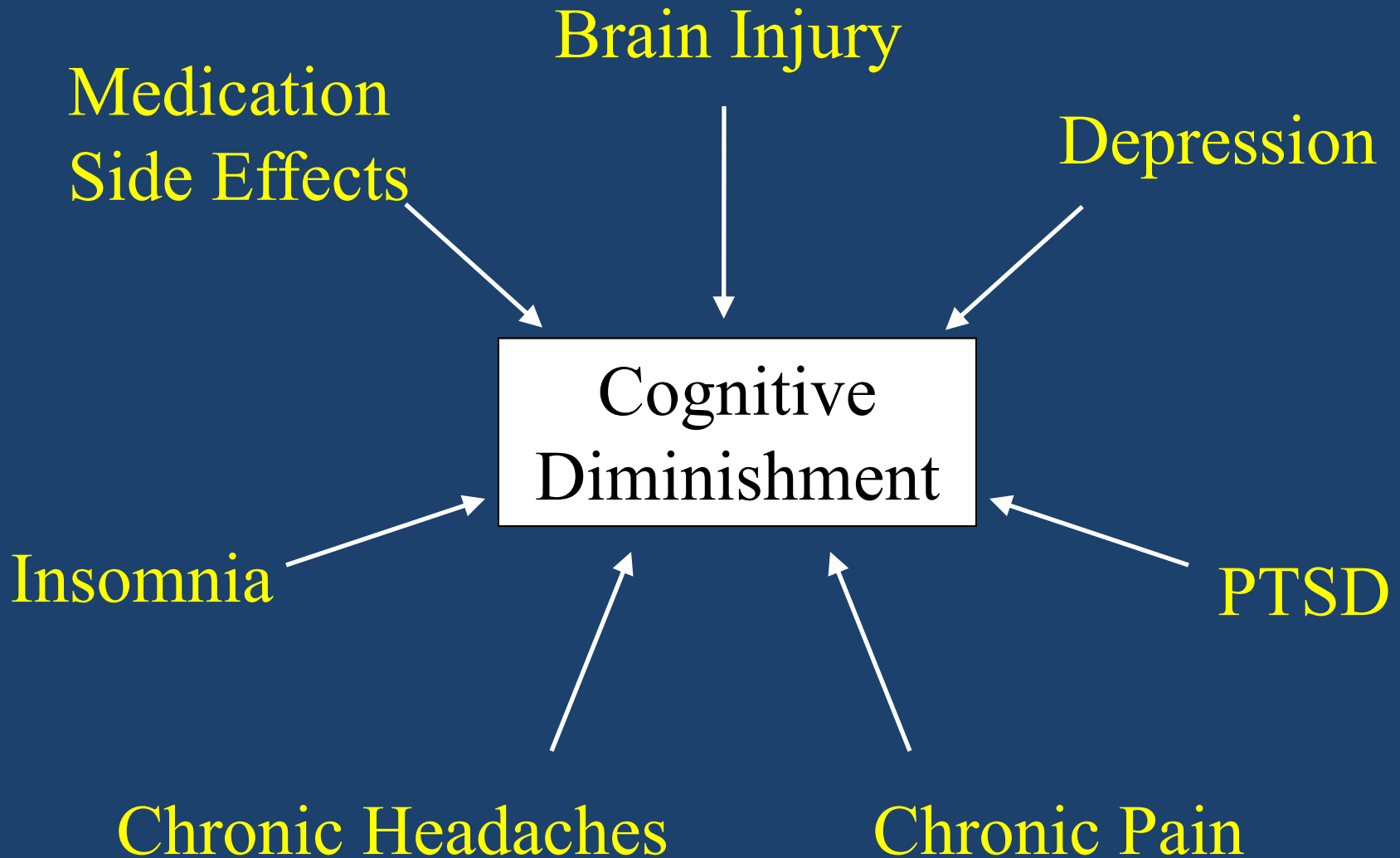


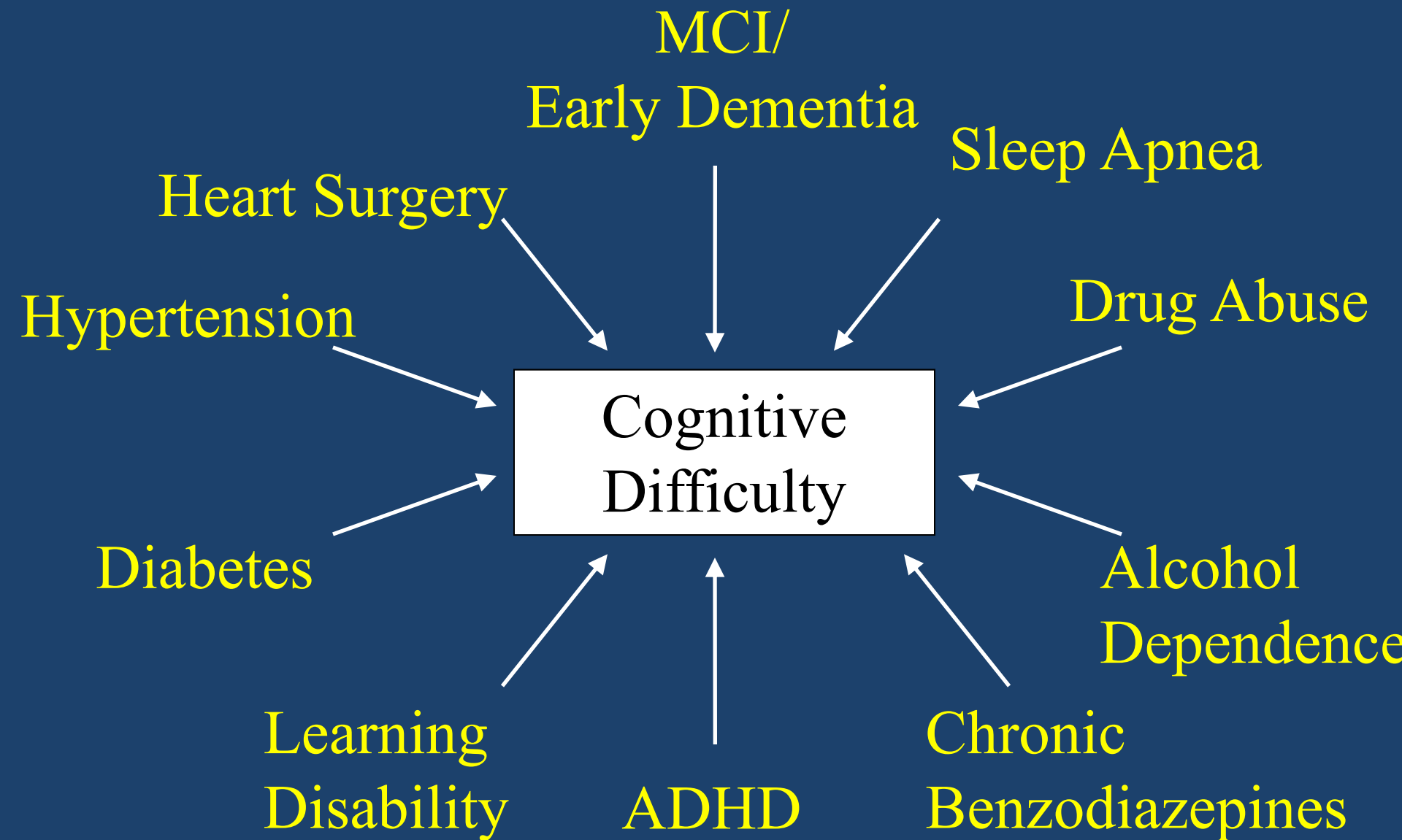
#4

Can Neuropsychological Assessment
Accurately Detect Long-Term Cognitive
Problems Clearly Attributable to an
MTBI?

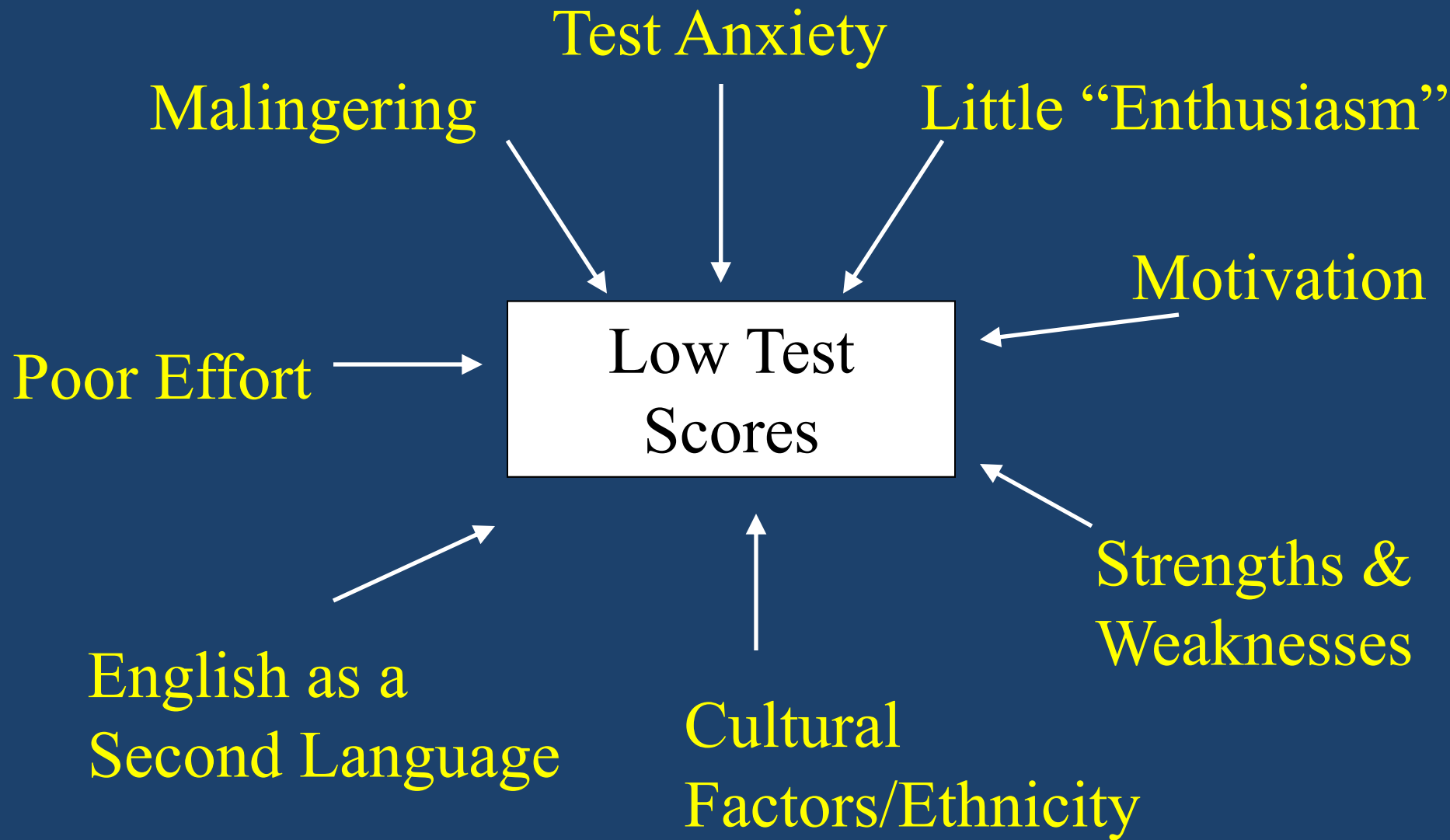
Usually not (but sometimes, if there
are few confounding factors)

Possible Effects on Cognition





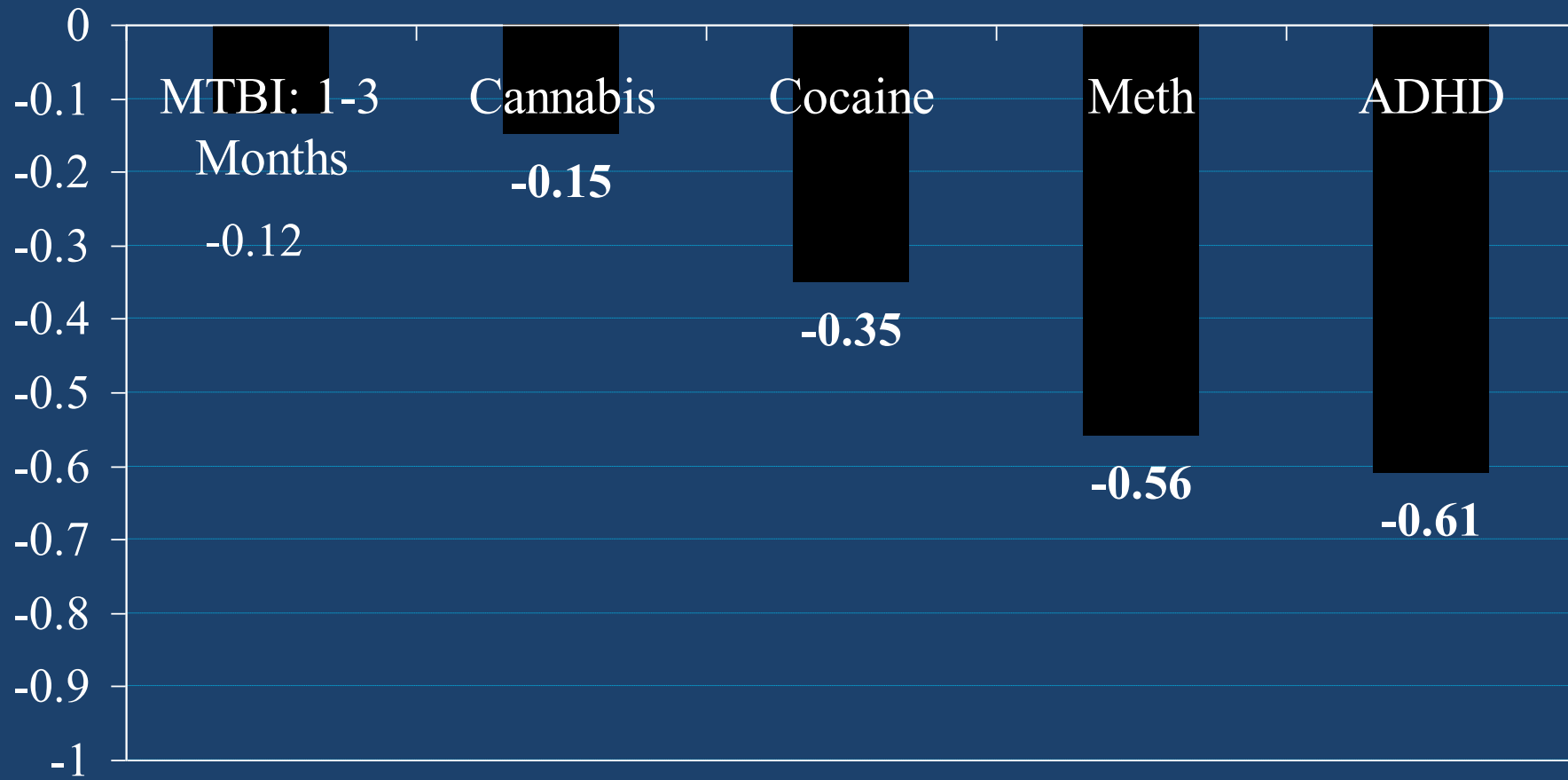
Factors Affecting Test Performance



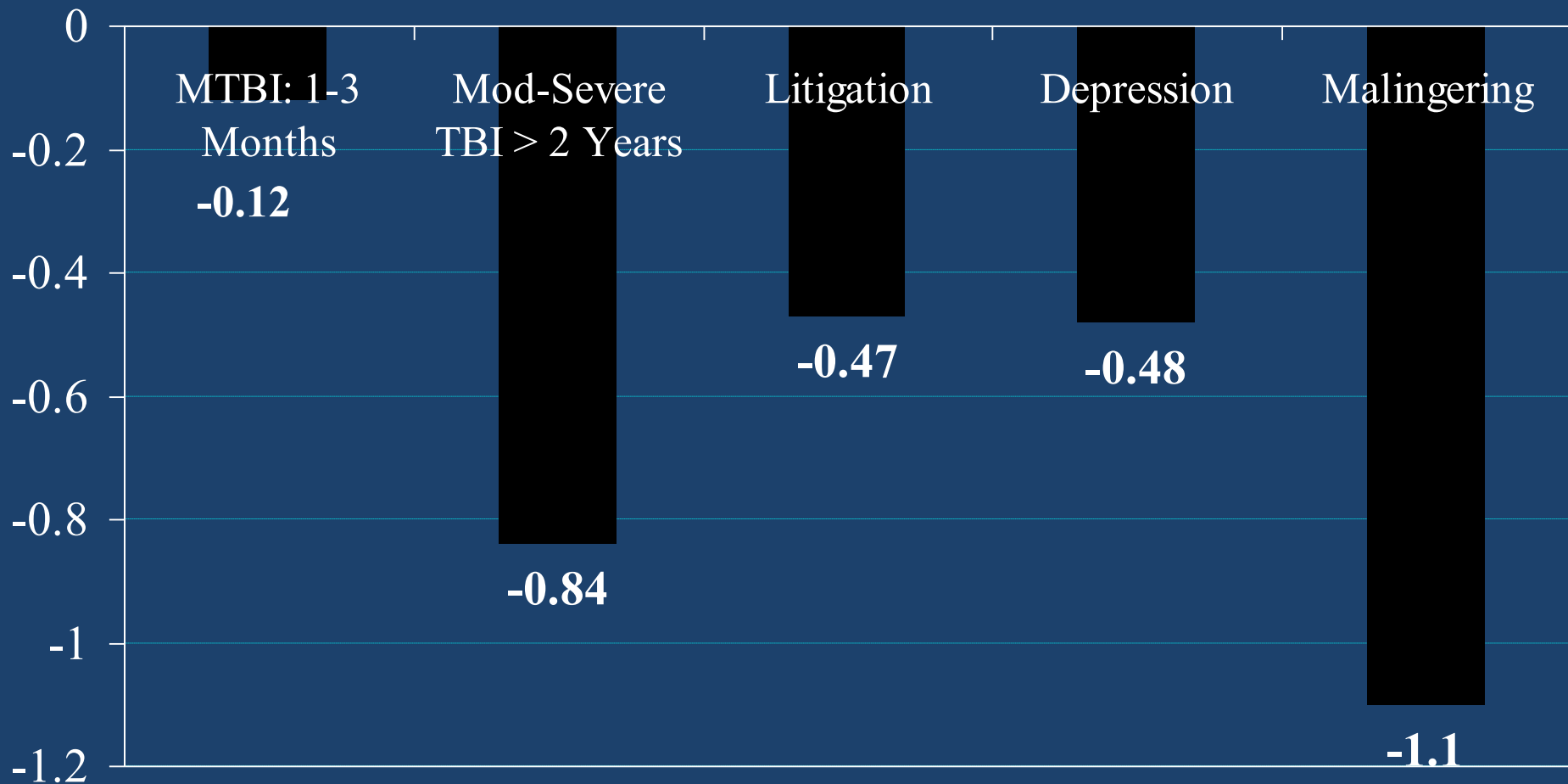
Overall Effects of Poor Effort on Neuropsychological Functioning?

Results from Meta-Analyses

Adverse Neuropsychological Effects



Adverse Neuropsychological Effects



#5

It is easy to misdiagnose
cognitive impairment

How Do You Define Impairment?

- Scores below the 16th percentile (1 SD)?
- Scores below the 10th percentile?
- 5th percentile?
- 2nd percentile (2 SDs)?

Prevalence of Low Scores in Healthy Adults?

- Most neuropsychologists don't know
- Higher the cut-off, greater the number of low scores
- More tests you give, the more likely you are to get low scores

Neuropsychological Assessment Battery (NAB)

- Takes approximately 3.5 hours to administer
- 24 tests
- 36 Primary Test Scores
- MANY additional test scores

Impairment = 5th Percentile

- What percentage of healthy adults have one or more low scores?

70%

- 3 or more? 31%

- 5 or more? 16%

Impairment < 1 SD (16th percentile)

- What percentage of healthy adults have one or more low scores?

92%

- 3 or more? 66%

- 5 or more? 44%

Misdiagnosis of Cognitive Impairment

- Longstanding strengths and limitations
- Pre-existing conditions
- Co-occurring conditions
- Confounds (e.g., effort, fatigue, or cultural factors)
- Low scores are common in healthy adults
- Capitalizing on chance findings

#6

In recent years, evidence-based algorithms have been developed for more accurately identifying cognitive impairment

Unfortunately, most neuropsychologists are not aware of these developments

Domain-Specific Base Rates

That is: The Prevalence of Low Scores in
Healthy Adults by Specific Cognitive
Domain

Processing Speed: WAIS-IV

(Coding, Symbol Search, Cancellation)

- Scaled Score = 7 or lower (16th percentile)
 - 1 or more low scores = 36.3%
 - 2 or more low scores = 17.4%
 - 3 low scores = 5.5%
- Scaled Score = 5 or lower (5th percentile)
 - 1 or more low score = 12.8%
 - 2 or more low scores = 3.9%
 - 3 low scores = 0.7%

Working Memory: WAIS-IV

(Digit Span, Arithmetic, Letter Number Sequencing)

**Scaled Score = 7 or lower
(16th Percentile)**

- 0 low scores = 68.2%
- 1+ low score = 31.8%
- 2+ low scores = 13.7%
- 3 low scores = 5.0%

**Scaled Score = 5 or lower
(5th Percentile)**

- 0 low scores = 90.2%
- 1+ low score = 9.8%
- 2+ low scores = 2.9%
- 3 low scores = 0.6%

Raising the criterion for a low score
in high functioning people
(25th percentile?)

Patient who is 5 Days Post Injury

(High Average IQ)

- WAIS-IV Working Memory
 - Digit Span = 11 (63rd percentile)
 - Arithmetic = 8 (25th percentile)*
 - Letter Number Sequencing = 8 (25th percentile)*
- Probability in Healthy Adults With High Average IQs = 2.5%*

Patient 5 Days Post Injury

(High Average IQ)

- WAIS-IV Processing Speed
 - Coding = 8 (25th percentile)*
 - Symbol Search = 10 (50th percentile)
 - Cancellation = 8 (25th percentile)*

Probability in Healthy Adults with High Average IQs = 12.7%*

Conclusions

- Neuropsychological Assessment relies heavily on self-reported symptoms and cognitive testing
- Symptoms and cognitive testing can be influenced by many factors
- Healthy people get some low scores on neuropsychological testing
- There are new statistical methods for identifying cognitive impairment more accurately

Thank you

EXHIBIT 7

NFL CONCUSSION LAWSUITS

An  Anapol Schwartz Information Website

NFL Concussion Lawsuit News | Contact & Locations | Full NFL Lawsuit Complaint

(888) 209-2626

NFL CONCUSSION LAWSUITS

NFL CONCUSSION LAWYERS

CONCUSSION SYMPTOMS

TRAUMATIC BRAIN INJURY

CHRONIC TRAUMATIC ENCEPHALOPATHY

Chronic Traumatic Encephalopathy (CTE) is a progressive degenerative brain disease commonly found in athletes with a history of concussions and other brain trauma.



Repetitive head trauma triggers progressive degeneration of the brain tissue that can begin decades after the last incident, according to an article by the Center for the Study of Traumatic Encephalopathy at the Boston University School of Medicine and Sports Legacy Institute.

Symptoms of CTE include dementia, aggression, depression, memory loss, confusion, impaired judgment and impulse control problems.

After former San Diego Charger Junior Seau shot himself in the heart in May 2012, researchers found he had suffered from CTE. An autopsy report of former Atlanta Falcons player Ray Easterling, who committed suicide after filing the first

federal NFL concussion lawsuit with attorneys Sol Weiss and Larry Coben, found that he also had CTE. Easterling played for the Falcons for eight seasons in the 1970s and suffered from dementia and depression for years after he retired.

Dozens of deceased former players were also found to have had the degenerative condition, a conclusion made by brain specialists consulted by the National Institutes of Health in Washington.

NFL CONCUSSION LAWSUITS



More than 200 NFL concussion lawsuits from across the country have been consolidated in Philadelphia.

[READ MORE](#)

NFL CONCUSSION LAWYERS



Anapol Schwartz attorneys Sol Weiss and Larry Coben are leaders in the National Football League Players' Concussion Injury Litigation.

[READ MORE](#)

LIVE CHAT



DISCLAIMER:

This website is dedicated to providing public information regarding Concussions lawsuits and other legal information. None of the information on this site is intended to be formal legal advice, nor the formation of an attorney-client relationship. Please contact Sol Weiss and Larry Coben for information regarding your particular case.

ABOUT US



The attorneys at Anapol Schwartz have many years of experience with the complexities of multidistrict litigation and are dedicated to helping people like you.

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NFL CONCUSSION LAWSUIT NEWS

Judge Grants Preliminary Settlement Approval in NFL Concussion Lawsuits

Villanova Interview with NFL Concussion Lawyer Sol Weiss

Anapol Schwartz Announces \$765 Million Proposed Settlement with NFL

Judge Orders Mediation in NFL Concussion Lawsuits

EXHIBIT 8

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NATIONAL FOOTBALL LEAGUE CONCUSSION LITIGATION

The United States Panel on Multi-District Litigation (JPMDL) recently issued an order consolidating all of the cases which have been filed in the National Football League Players' Concussion Injury Litigation and assigning them to the Honorable Anita B. Brody in the United States District Court for the Eastern District of Pennsylvania. Gene Locks was among those who argued before the panel for the assignment of the litigation to Philadelphia and with its primary office in that City the Locks Law Firm is positioned to play a major role in the litigation.

The Firm filed one of the first class action lawsuits in the country, in the Eastern District of Pennsylvania, seeking to compel the NFL to provide medical monitoring for repetitive concussion and cumulative head trauma for former players who are or could in the future be victims of the repetitive traumatic brain injury they sustained while playing in the NFL. The Locks Firm has also filed separate lawsuits on behalf of former NFL players seeking damages, treatment and medical monitoring for the neurological injuries those players sustained during their NFL careers. The Locks Law Firm is committed to obtaining complete and valid treatment, medical monitoring and all appropriate damages for victims and their families. The investigation into this problem has revealed that repetitive traumatic brain injuries sustained by former NFL players during their careers is pervasive and possibly an epidemic.

In our view, the NFL in the past has failed to address this problem, attempted to diminish its importance, and actively sought to dispute the connection between latent brain disease and repetitive traumatic brain injury sustained by NFL players. At no time was this conduct in the best interests of the players or their short-term and long-term neurological health. Rather than implement a system that put the players' short-term and long-term health as the NFL's primary concern, the NFL obfuscated, minimized, and even falsified the risks of repetitive head trauma. The NFL now treats these injuries legally as a "workman's compensation issue".

Brain injuries are among the most debilitating personal injuries any victim can sustain; their consequences are often progressive, permanent, and sometimes fatal. They affect not only the injured person, but family members and close friends as well. For many years, all credible scientific evidence leads to the conclusion that individuals who suffer repeated and cumulative trauma to the head are at significantly increased risk for permanent brain injuries. All NFL players are therefore at increased risk.

The Locks Law Firm is internationally recognized for its representation of brain injured victims, as well as its representation of mass torts victims. You may participate in this lawsuit at no cost to you or your family. There may be time limits which govern your ability to sue, so you should speak with an attorney about this matter as soon as possible. If you would like us to represent you, please complete and submit the questionnaire below and answer the questions.

* indicates a required field

First Name:

Last Name:

* Address me as:

* Email:

Date of Birth:

Address: Home Phone:

Work/Cell Phone:

Marital Status:

Spouse's Name:

Please identify each NFL team with which you were employed and the dates when you were employed by each team.

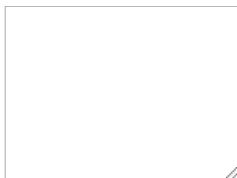
Please identify each position you played while employed by an NFL team and the dates you played the position identified.

Have you ever sustained or experienced a concussion or concussion-like symptoms during practices, workouts, and/or games while employed by any NFL team?

Yes ☐

No ☒

If the answer is yes, please identify each instance when you sustained or experienced a concussion or concussion-like symptoms of any kind, and please provide the approximate year (and possibly month) and with what teams were you employed at that time.

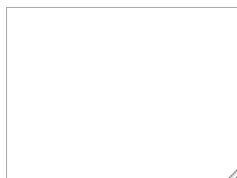


Have you ever seen a physician or medical professional about any concussion, concussion-like symptom, persistent headaches, dizziness, and/or inability to concentrate and/or any other issue that you believe is related to concussions, concussion-like symptoms?

Yes ☐

No ☒

If the answer is yes, please identify the physician(s) and/or medical professional(s) you have seen about any concussion, concussion-like symptom, persistent headaches, dizziness, and/or inability to concentrate. Hospital/Facility Name, State, Zip, Phone:



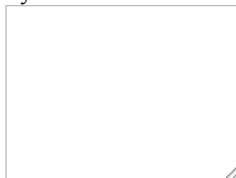
Physician or Medical Provider Name, State, Zip, Phone:

Have you ever been hospitalized in connection with a concussion, concussion-like symptom, persistent headache, dizziness, and/or inability to concentrate?

Yes ☐

No ☒

If the answer is yes, please identify the hospital or clinic in which you received treatment and the approximate year and month when the



treatment took place. Hospital/Facility Name, State, Zip, Phone:



Surgeon's Name, State, Zip, Phone:

Please provide a brief summary of any current issues, concerns and/or problems you believe are in any way related to concussions,



concussion-like symptoms, and/or head trauma you sustained while playing for any NFL team.

Accept retainer agreement ([click here for full agreement](#)):

Yes ☐

No ☒

Experienced, Aggressive Legal Representation



The personal injury attorneys at the Locks Law Firm have decades of courtroom experience which they are ready to put to work in your case. Throughout Philadelphia, New York and New Jersey, our personal injury attorneys have earned reputations as tough, dedicated litigators who zealously advocate for the legal rights of their clients. We have a [proven history of earning large jury verdicts and negotiated settlements](#) for our clients.

Representing Victims Throughout the Northeast

The Locks Law Firm has offices conveniently located in [Philadelphia, Pennsylvania](#); [Cherry Hill, New Jersey](#); and [Manhattan, New York City](#). Our personal injury attorneys are well positioned to meet with and represent clients across the Northeast. We are a large, diverse law firm representing clients in a variety of legal cases. Our experience and dedication to the rights of our clients is unmatched.

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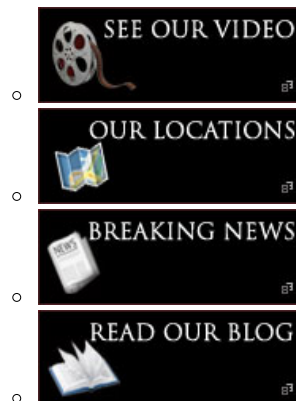
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The Pennsylvania, New York, and New Jersey personal injury attorneys at the Locks Law Firm are vastly experienced at helping clients receive large financial awards to compensate them for their

EXHIBIT 9



ESPN.com: OTL

[\[Print without images\]](#)

Monday, September 29, 2014

Updated: September 30, 12:29 PM ET

OTL: Belcher's brain had CTE signs

By Steve Delsohn
Outside The Lines

The brain of former [Kansas City Chiefs](#) linebacker Jovan Belcher -- the 25-year-old player who shot and killed his girlfriend in 2012 before committing suicide -- showed signs of pervasive brain damage like that found in other deceased NFL players, according to a neuropathologist.

In a report obtained by "Outside the Lines," Dr. Piotr Kozlowski writes that he detected neurofibrillary tangles of tau protein, which is identified with chronic traumatic encephalopathy. The tangles were distributed throughout Belcher's hippocampus, an area of the brain involved with memory, learning and emotion.

Dozens of former NFL players have been diagnosed posthumously with CTE, a neurodegenerative disease linked to dementia, memory loss and depression. The disease, researchers say, is triggered by repeated head trauma.

On Dec. 1, 2012, Belcher [shot and killed girlfriend](#) Kasandra Perkins, the mother of his then-3-month-old daughter. Belcher then drove to the Chiefs' practice facility, where he shot himself in front of team officials in the parking lot. While the murder-suicide reignited the debate over athletes and guns, it also increased the focus on a frequently overlooked issue at the time: the NFL's domestic violence problem.



Jovan Belcher fatally shot his girlfriend, Kasandra Perkins, multiple times before killing himself at Arrowhead Stadium on Dec. 1, 2012.

Belcher's [body was exhumed](#) one year after his death, and his brain was examined two weeks later. Kozlowski was hired to diagnose the brain by court-appointed Kansas City attorneys who represent the interests of Belcher's daughter. Belcher's mother, Cheryl Shepherd, initiated the process of exhuming her son's body to have his brain studied, attorney Dirk Vandever said.

Vandever declined to comment about why his law firm released Kozlowski's findings now, almost nine months after the diagnosis. "Outside the Lines" requested copies of images of Belcher's brain to send to another neuropathologist for independent analysis, but that request was denied.

Neurosurgeon Dr. Julian Bailes, chairman of the department of neurosurgery and co-director of the NorthShore Neurological Institute in Chicago, did not study Belcher's brain but said of the possible findings: "It is of great interest. Violence against others is not typically part of the CTE picture. But it was in the case of [\[former professional\] wrestler Chris Benoit](#). It would be nice to have these findings corroborated.

"If correct, they're very compelling."

If it can be shown that Belcher did have CTE, Belcher's daughter and mother, together, would be eligible for up to \$4 million under the proposed concussion settlement between the NFL and former players. Furthermore, the lawyers representing Belcher's daughter have filed a wrongful-death lawsuit against the Chiefs on her behalf. Belcher's mother, with different attorneys, [filed an almost identical suit](#).

Among the allegations contained in the lawsuits is that Belcher was knocked unconscious during a game against the [Jacksonville Jaguars](#) in 2009 and did not receive adequate treatment. The lawsuits also refer to a November 2012 game against the [Cincinnati Bengals](#) when, the lawsuits allege, Belcher "suffered what should have been recognized as an acute concussion." However, one lawsuit continues, "despite exhibiting obvious symptoms, Decedent was never removed from play for evaluation and recovery." The lawsuits also claim Belcher exhibited signs of CTE, including changes in his mood and behavior.

"The NFL has a long history of a changing the rules of the game to make it safer on the field, providing players the best medical care, and updating protocols on diagnosing concussions, treating concussions, and returning to play after a concussion," the league said in a statement.

The NFL said it has funded \$161 million in CTE and related research projects, including a \$30 million grant to the National Institutes of Health in 2012.

The Chiefs declined to comment.

Kozlowski, through Vandever, was not made available for comment. According to the American Board of Pathology, he is certified in anatomic pathology and neuropathology. He was formerly a program director at the National Institutes of Health Institute for Neurological Disorders and Stroke in Maryland. Kozlowski serves as the dean of research and pathology professor at the Touro College of Osteopathic Medicine in New York City.

Vandever said Belcher's mother had the idea of having her son's brain studied after reading multiple reports about football players and CTE. He declined to discuss why Kozlowski was chosen as opposed to researchers who are more experienced in the study of CTE and football players -- those from Boston University and the NIH, for example.

As for Belcher's brain being examined slightly more than a year after his death, Kozlowski's report refers to some brain decomposition, with certain parts better preserved than others. Bailes said it is possible to find evidence of tau protein and CTE-like changes a year after a death.

Bailes, who has studied the connection between football players and head injuries, worked on the case of Andre Waters, a former Philadelphia Eagles safety who committed suicide by shooting himself in the head. "Even in this case of a gunshot wound to his brain, it was possible to diagnose him with CTE," Bailes said of Waters.

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